PB-217 630

A REPORT OF WATER POLLUTION IN THE KANSAS RIVER BASIN

Public Health Service
Kansas City, Missouri

February 1953

DISTRIBUTED BY:

NTIS
National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

Water Pollution Series No. 38

PB 217 630

TD420
.U58
no. 38

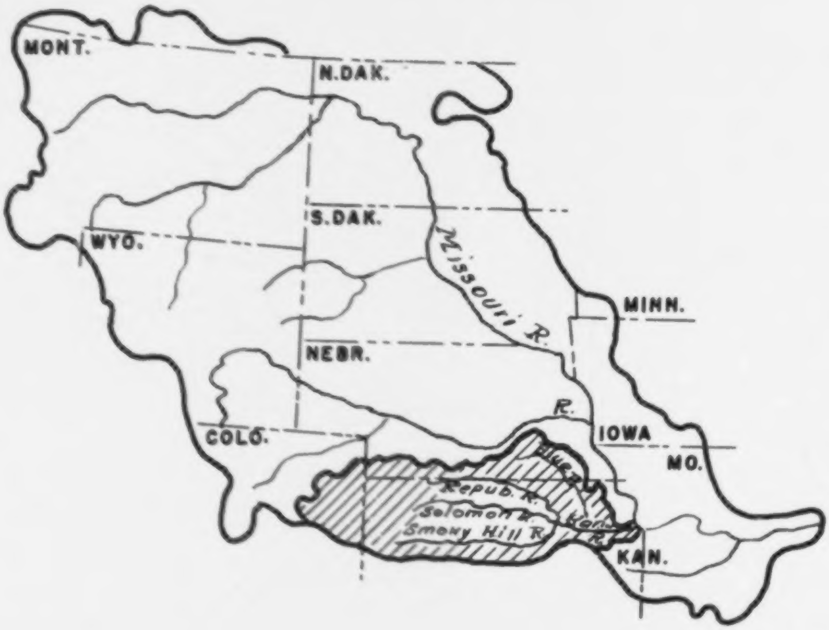
LIBRARY
SANITARY ENGINEERING CEN
CINCINNATI, OHIO

For Clean Water—"One River, One Plan."

KANSAS RIVER DRAINAGE BASIN

A COOPERATIVE STATE-FEDERAL REPORT ON WATER POLLUTION

FEBRUARY 1953


MONT.
N.DAK.
S.DAK.
WYO.
Missouri R.
MINN.
NEBR.
R.
IOWA
COLO.
MO.
River
Repub. R.
Solomon R.
Smoky Hill R.
Kans. R.
KAN.

COLORADO
Department Of Public Health

KANSAS
Board Of Health

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

NEBRASKA
Department Of Health

FEDERAL SECURITY AGENCY
Public Health Service

15

A REPORT OF WATER POLLUTION
IN THE
KANSAS RIVER BASIN

Prepared by

COLORADO DEPARTMENT OF PUBLIC HEALTH
Division of Sanitation

KANSAS STATE BOARD OF HEALTH
Division of Sanitation

NEBRASKA DEPARTMENT OF HEALTH
Division of Sanitation

PUBLIC HEALTH SERVICE
Division of Water Pollution Control
Missouri Drainage Basin

Federal Security Agency
Public Health Service

FEBRUARY 1953

TD420
.U58
no.38

Public Health Service Publication No. 234

TABLE OF CONTENTS

KANSAS DRAINAGE BASIN REPORT

Page

Introduction 1
Acknowledgments 2
Summary 3
Conclusions 5
Recommendations 6
General Description 9
    Historical Background 9
    Physical Description 10
    Economic Development 10
Uses of Water Resources 14
Sources of Pollution 19
Damages to Water Resources from Pollution 25
Benefits Resulting from Pollution Prevention and Abatement 28
Pollution Prevention Measures in Effect 29
Pollution Prevention Measures Needed 33

TABLES

Table 1 - Project list - Municipalities and industries needing improvements for abatement of pollution 7
Table 2 - Population of municipalities 12
Table 3 - Municipal water supplies from ground sources 15
Table 4 - Municipal surface water supplies 17
Table 5 - Basic data on sources of municipal pollution 20
Table 6 - Basic data on sources of industrial pollution 23
Table 7 - Comparison of 1922 and 1948 coliform data 26
Table 8 - Progress in pollution abatement 30
Table 9 - Summary of existing treatment 30
Table 10 - Adequacy of existing treatment facilities - municipal and industrial 32
Table 11 - Needs for municipal and industrial waste treatment plants 40
Table 12 - Current status of municipal and industrial action on pollution abatement needs 40

MAPS

Map 1 - General Reference Map 8
Map 2 - Existing Primary Water Resources 18
Map 3 - Sources of Pollution and Existing Treatment Facilities 24
Map 4 - Pollution Abatement Needs 38

4495
LIBRARY
SANITARY ENGINEERING CENTER
CINCINNATI, OHIO

INTRODUCTION

The Federal Water Pollution Control Act requires the Surgeon General of the Public Health Service to cooperate with Federal agencies, State and interstate water pollution control agencies, and municipalities and industries in the preparation or adoption of comprehensive programs for eliminating or reducing pollution of interstate waters and tributaries thereof, and improving the sanitary condition of surface and underground waters. Due regard must also be given to improvements necessary to conserve the waters for public and industrial water supplies, propagation of fish and aquatic life, recreational purposes, agricultural and other legitimate uses.

This report is produced under the cosponsorship of the Colorado Department of Public Health, the Kansas State Board of Health, the Nebraska Department of Health, and the Public Health Service. It is based on data gathered and reported in the Kansas River Basin Water Pollution Investigation Report[1] of 1949 and subsequent information. The report presents data concerning use of water resources, pollution entering water resources and resulting damages, benefits which may result from pollution prevention and abatement, pollution prevention measures in effect, and those needed.

A sincere effort has been made to present a picture of the water pollution problems in the Kansas River Basin.

Basic knowledge now available is sufficient to permit immediate solution of most of these problems without awaiting the results of additional surveys and studies.

It is our hope that this report, as a step in the cooperative development of an ultimate comprehensive water pollution control program, will help in safeguarding our water resources.

---

[1] The 1949 technical report is available upon request addressed to any of the above cooperating agencies.

ACKNOWLEDGMENTS

Acknowledgment is made of the use of the Kansas River Basin Water Pollution Investigation report and to the cooperating agencies responsible for its publication. Much information was also gained from the published reports of the Corps of Engineers, Department of the Army; the Bureau of the Census, Department of Commerce; the Fish and Wildlife Service, the Geological Survey, the Bureau of Reclamation, and the National Park Service, Department of Interior.

Thanks is tendered to the reviewing agencies whose comments have materially aided the preparation of the report. These include the Corps of Engineers, Missouri River Division, Omaha, Nebraska; Bureau of Reclamation, Region VII, Denver, Colorado; National Park Service, Omaha, Nebraska; Fish and Wildlife Service, Billings, Montana; Department of Agriculture, Lincoln, Nebraska; Federal Power Commission, Chicago, Illinois; Department of Commerce, Denver, Colorado; and the Division of Water Pollution Control, Public Health Service, Washington, D. C.

SUMMARY

The Kansas River system drains an area of approximately 60,000 square miles, of which 16 percent is in northeast Colorado, 24 percent in southern Nebraska, and 60 percent in northern Kansas. Principal tributaries of the Kansas River include the Big Blue, Republican, and Smoky Hill Rivers. The Kansas River, a comparatively short stream flowing eastward 169 miles from Junction City to its confluence with the Missouri River at Kansas City, Kansas, has an average annual flow of about 8,000 c.f.s.

Principal uses of the streams, prior to the Missouri River Basin water and land resource development and conservation program, included domestic and industrial water supplies, livestock watering, limited recreation and fishing, some irrigation, and removal and ultimate disposal of municipal sewage and industrial wastes. Extensive hydroelectric power or navigation had not developed. The construction of multiple purpose reservoirs has enhanced flood control and the use of water for irrigation and recreation.

An estimated 1,200,000 people reside in the region. Kansas City, Kansas, with 130,000 people, is the largest city; other principal cities include Topeka, Manhattan, and Salina, Kansas; a portion of Kansas City, Missouri; McCook, Hastings, and Beatrice, Nebraska, and Burlington, Colorado.

The Basin's economy stems from agriculture. Kansas City and Topeka are railroad and industrial centers and, with other municipalities, are focal points for collection and distribution of agricultural products. Large quantities of oil are produced principally in the headwater areas of the Solomon, Saline, and Smoky Hill Rivers.

Extreme droughts and devastating floods have stricken the area. Existing multiple purpose reservoirs at Kanopolis and Cedar Bluff, Kansas; Harlan County, Medicine Creek, and Enders, Nebraska; and Bonny, Colorado, together with reservoirs proposed at other sites, are planned to provide protection against flooding. Irrigation from multipurpose reservoirs should greatly aid in stabilizing agriculture. In most instances the stream regulation program will insure a minimum flow consistent with reasonable sewage and industrial wastes treatment.

Water quality impairments have occurred in reaches below sources of pollution. There are 169 sources of municipal pollution and 29 sources of separately sewered industrial pollution which contribute to Basin watercourses wastes having 1,497,000 population equivalents.

Industrial plants in Topeka, Lawrence, and Kansas City, Kansas; and Kansas City, Missouri, discharge great quantities of organic matter. These include meat packing industries and the Kansas City, Missouri, garbage disposal station. Untreated industrial wastes of considerable magnitude also emanate from Red Cloud, Superior, Beatrice, and Fairbury, Nebraska; Manhattan and Lawrence, Kansas.

Salt brines originating in central Kansas in the basins of the Smoky Hill, Solomon, and Saline Rivers contribute to deterioration of water quality. Much of the sodium chloride content of these rivers is from natural salt deposits underlying the region, although brine pollution from the oil industry continues to be a factor. The oil industry has spent more than $15,000,000 to correct brine pollution.

Pollution has damaged domestic and industrial water supply, livestock water, fishing and recreation, and land and property values. Water supplies that are at times adversely affected by pollution include the municipal supplies at Marysville, Topeka, and Lawrence, Kansas, and industrial supplies at Topeka, Lawrence, Sunflower Ordnance Works, and Kansas City, Kansas. Water treatment facilities for these communities must contain extra units to control excessive contamination, thus increasing construction, operation, and maintenance costs. Livestock watering is curtailed by pollution, adding to production costs. Moreover, consumption of polluted water is inimical to livestock health. Due to the silt content streams are not naturally good fisheries except in localized areas and excessive pollution has established effective barriers against fish migration, thereby curtailing local recreational usage. People who boat and swim in sewage contaminated streams are subjected to health hazards.

Pollution abatement and control would result in benefit from improvement of water quality for domestic use, industrial supplies, fishing and recreational activities, livestock watering; protection of irrigation waters from contamination; and elimination of nuisances. Further reduction of oil well brine pollution would enhance the use of waters for irrigation, domestic purposes, and livestock watering. The brine disposal program has had a marked beneficial result in streams not subject to natural chloride contamination.

The need has been established for new plants, replacements, or improvements at 82 municipalities and 24 separately sewered industries. In the past six years new treatment plants have been provided at 22 municipalities. This is a remarkable tribute to the water pollution control agencies and the people of the Basin States. The State of Kansas, through the leadership of the State Board of Health, has been very active in this respect. Wise legislative action in Kansas has provided a background for rapid progress. Revision of the statutes governing stream pollution control is being studied by interested groups in Colorado and Nebraska.

The cost of the recommended municipal and industrial waste treatment program is estimated at $18,000,000. This is a conservative figure and does not include the cost of providing trunk sewers, operation, or maintenance.

CONCLUSIONS

1. Execution of the Kansas River Basin land and water resource development program will promote increased water usage for irrigation and recreation.

2. The water pollution control program instituted by the States will result in benefits from improved and extended use of domestic and industrial water supplies, livestock watering, fishing, recreation, and irrigation, and from nuisance prevention.

3. Wastes are discharged from 169 sewered municipalities and 29 separately sewered industries. The organic wastes reaching the waterways is estimated as equivalent to that from about 1,497,000 people, 86 percent of which enter the Kansas River in its lower 10-mile reach.

4. Interstate pollution occurs in three river reaches where pollution discharged by Nebraska communities near the Nebraska-Kansas State line extends into Kansas.

5. There is need for 47 new municipal waste treatment plants, and 35 existing municipal plants require enlarging, additional units, or replacements. New treatment plants or improved methods of wastes control are needed at 24 industrial plants.

6. State water pollution control agencies, abetted by local communities, are conducting a campaign against the pollution of water resources. Seventy-two percent of the municipalities with sewer systems provide some degree of treatment.

7. High chloride content in streams of the Smoky Hill river system is from natural salt formations and oil field brines. The Kansas State Board of Health has succeeded, through its oil well brine disposal program, in reducing wastage of salt water into the waterways and expects to continue improving its control of this pollution.

8. The Kansas State Board of Health is to be commended upon its development of a comprehensive water pollution control program in its portion of the Basin. Results of this activity are already apparent. Nebraska and Colorado need adequate statutory backing to enable their agencies to execute a comprehensive water pollution control program.

9. Municipal financing legislation of Kansas is generally adequate to enable construction of municipal wastes treatment facilities but does not, in all cases, permit revenue bond financing for operation and maintenance.

RECOMMENDATIONS

It is recommended that:

1. The legislatures of Colorado and Nebraska adopt comprehensive water pollution control legislation.

2. The municipal finance laws in Kansas be amended to permit revenue financing for the construction, operation and maintenance of waste treatment works in all classes of municipalities.

3. The municipalities and industries listed in table 1 provide adequate waste treatment facilities, and chlorination of plant effluents where downstream water uses require this additional protection.

4. The reservoir operation programs for water resources developments include operational objectives which provide the releases for public health and sanitary needs. Objectives for operation of Harlan County Reservoir is an example of reservoir operation adapted to implement stream sanitation.

5. The State of Kansas continue to improve its control over brine disposal to afford increasing protection to ground and surface water supplies.

6. The program of educating the public concerning damaging effects of sewage and industrial wastes in Basin streams be continued and intensified.

Table 1. Kansas River Basin - Project List - Municipalities and Industries Needing Improvements for Abatement of Pollution

Name	Population Served	Project Needs
Abilene	5,200	Enlarge (Primary)
Clifton	300	Ready for Bids
Ellsworth	230[a]	New Plant (Secondary)
Slaughterhouse		
Forbes Air Force Base	8,000	Additions (Secondary)
Goodland	4,000	Enlarge (Secondary)[1]
Hoxie	900	Additions(Secondary)
Kansas City	38,000	New Plant (Primary)
Missouri Valley Serum Co.)	693,000[b]	New plants or connect to Kansas City, Kansas System
Armour and Co.)		
National Laboratory)		
Proctor & Gamble)		
National Cylinder Gas)		
Midwest Cold Storage)		
Wilson & Co.)		
Swift and Co.)		
Stockyards Co.)		
Santa Fe Railroad Co.)		
Union Pacific Railroad Co)		
Sinclair Refining Co.)		
Kansas City, Missouri	99,000	New Plant
Lawrence		
Lawrence Paper Mill	15,000	New plant or other control measures
Mission Township Sanitary Dist.	32,000	Enlarge
Norton		
Norton Ice & Meat Co.	100[a]	New plant or other control measures
Ogden	450	New Plant (Primary) Ready for bids.
St. Mary's College	220	Replace (Primary)
Sunflower		
Sunflower Ordnance	c	New plant (Secondary or other control measures) if village or plant is used.
Topeka	78,000[d]	Additions (Secondary)

1 - Treatment units under construction.
a - Organic population equivalent of waste discharged by industry.
b - Total industrial wastes population equivalent including 12 industries with separate outlets.
c - Inorganic wastes.

Table 1. Kansas River Basin - Project list - Municipalities and industries needing improvements for abatement of pollution

Name	Population served		Project needs
Colorado			
Burlington	2,200		Enlarge (Primary)
Cheyenne Wells	1,000		Additions (Secondary)
Haxtun	1,000		New plant (Primary)
Wray	2,100		Replace (Primary)
Kansas			
Abilene	5,200		Enlarge (Primary)
Alma	740		Additions (Secondary)[1]
Almena	450		Replace (Secondary)
Atwood	1,600		Replace (Secondary)
Belleville	2,200		Replace (Secondary)
Beloit	3,800		New plant (Primary)
Blue Rapids	1,200		New plant (Primary)
Bonner Springs	1,650		New plant (Primary)
Kuhn Cannery		13,400[a]	New plant (Primary or other control measures)
R. B. Rice Sausage Co.		290[a]	New plant (Primary or other control measures)
Chapman	700		New plant (Primary)
Clay Center	4,400		New plant (Primary)
Clifton	300		Enlarge (Primary)
Clyde	930		Enlarge (Primary)
Colby	3,500		Enlarge (Secondary)
Concordia	5,800		New plant (Primary)[2]
De Soto	500		New plant (Primary)
Downs	1,200		New plant (Secondary)
Ellsworth			
Slaughterhouse		230[a]	New plant (Secondary or equivalent)
Enterprise	700		New plant (Primary)
Eudora	900		New plant (Primary)
Forbes Air Base	8,000		Additions (Secondary)
Frankfort	1,100		New plant (Secondary)
Rendering plant		180[a]	New plant or other control measures[3]
Glasco	650		New plant (Primary)
Goodland	4,000		Enlarge (Secondary)[1]
Hanover	600		New plant (Primary)
Hays	6,400		Enlarge (Secondary)[2]
Horton	2,400		Replace (Secondary)
Hoxie	900		Additions (Secondary)
Junction City	12,000		New plant (Primary)
Kansas City	38,000		New plant (Primary)
Missouri Valley Serum Co.		693,000[b]	New plants or connect to Kansas City, Kansas, system
Armour & Co.			
National Laboratory			
Proctor & Gamble			
National Cylinder Gas			
Midwest Cold Storage			
Wilson & Co.			
Swift & Co.			
Stockyards Co.			
Santa Fe Railroad Co.			
Union Pacific Railroad Co			
Sinclair Refining Co.			
Kansas City, Mo.	99,000		New plant
Lawrence	23,000		New plant (Primary)
Lawrence Paper Mill		4,400[a]	New plant or other control measures
Mankato	1,150		Replace (Secondary)
Manhattan	20,000		New plant (Primary)
Patterson, Harwood Laboratory		2,670[a]	Connects to City of Manhattan
Dearborn Packing Plant		240[a]	
Kansas (cont'd)			
Marquette	550		New plant (Primary)
Marysville	3,800		New plant (Primary)
Minneapolis	1,650		New plant (Primary)
Mission Township Sanitary District	32,000		Enlarge (Secondary)[1]
Norton			
Norton Ice & Meat Co.		100[a]	New plant or other control measures
Ogden	450		New plant (Primary)
Olathe	5,500		Replace (Secondary)[1]
Onaga	780		Replace (Secondary)
Osborne	1,800		New plant (Secondary)
Russell	5,[illegible]00		Enlarge (Secondary)[2]
Scandia	500		New plant (Primary)
Sharon Springs	710		Replace (Secondary)
Solomon	750		New plant (Primary)
St. Marys	800		Replace (Primary)
St. Marys College	220		Replace (Primary)
Sunflower			
Sunflower Ordnance		(c)	New plant (Secondary or other control measures)
Topeka	78,000[d]		Additions (Secondary)
Tonganoxie	1,000		Replace (Secondary)
Franklin Ice Cream Co.		4,000[a]	New plant (Secondary)
Turner			
Grade and High Schools	1,100		New plant (Primary)
Valley Falls	1,000		New plant (Secondary)
Mitchell Sausage Factory		190[a]	New plant (Secondary or other control measures)
Wakefield	500		New plant (Primary)
Wamego	1,500		New plant (Primary)
Waterville	650		New plant (Primary)
Wilson	700		Enlarge (Secondary)[1]
Nebraska			
Arapahoe	1,200		New plant (Primary)
Ayr			
Slaughterhouse		350[a]	New plant (Primary)
Aurora	2,000		Enlarge (Secondary)
Beatrice	11,000		New plant (Secondary)
Beaver Crossing	300		Replace (Secondary)
Benkelman	1,500		Replace (Primary)
Crete	3,500		Enlarge (Secondary)
Culbertson	600		New plant (Primary)
Curtis	900		Enlarge (Secondary)
Fairbury	6,300		New plant (Primary)
Franklin	1,600		New plant (Primary)
Hastings	20,000		Enlarge (Secondary)
Hebron	2,000		New plant (Primary)
Milford	900		New plant (Primary)
Nelson	750		New plant (Secondary)
Orleans	900		New plant (Primary)
Red Cloud	1,700		New plant (Primary)
Seward	3,100		New plant (Primary)
Stromsburg	1,100		New plant (Secondary)
Superior	3,200		New plant (Primary)
Ulysses	300		New plant (Primary)
Wauneta	900		New plant (Primary)
Wilber	1,300		New plant (Primary)

---

[1] Treatment units under construction. Repairs to Wilson, Kansas, facilities under way.

[2] Financing arranged.

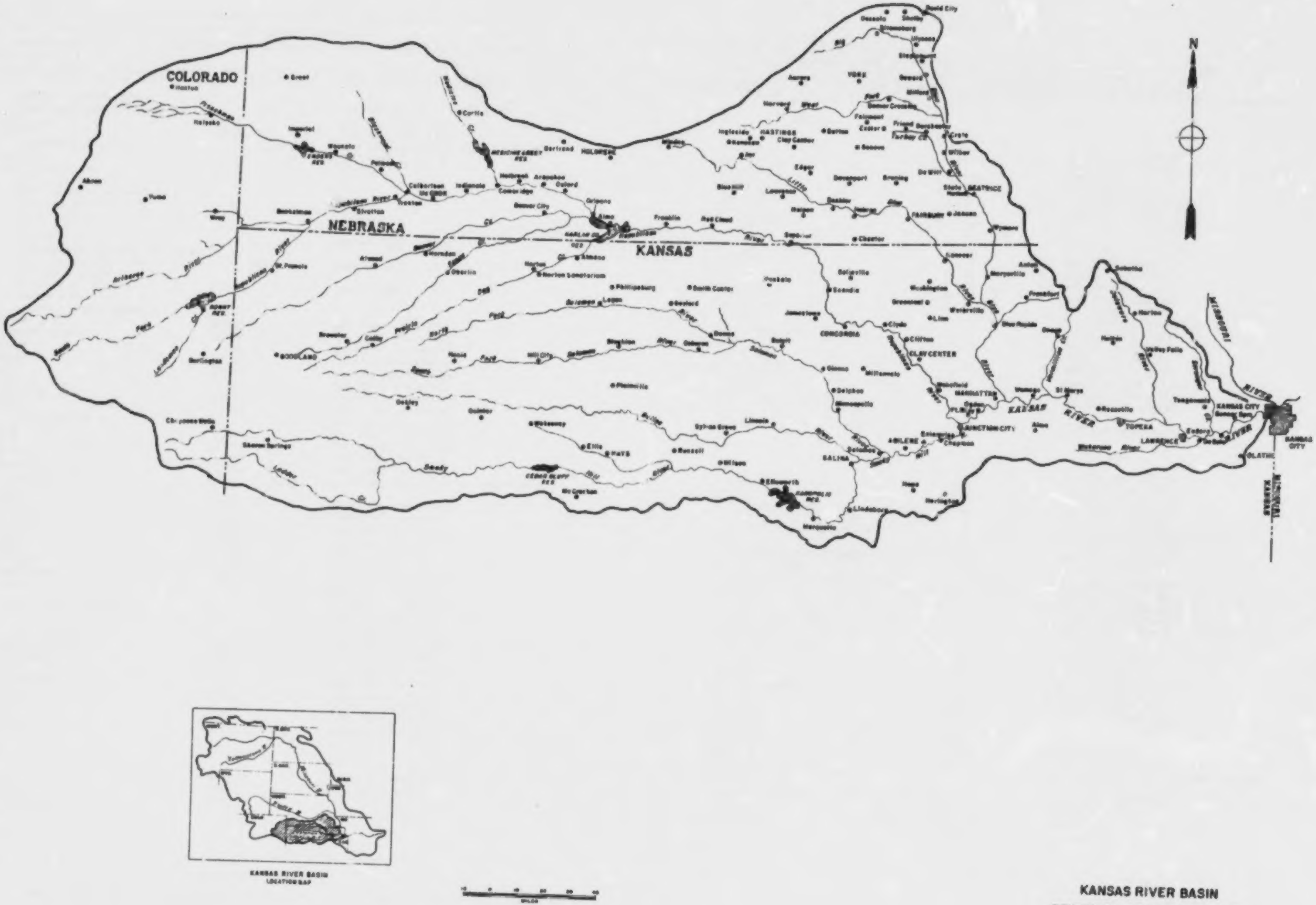
[3] As tentatively recommended by the State water pollution control agency having jurisdiction.

[a] Organic population equivalent of waste discharged by industry.

[b] Total industrial wastes population equivalent including 12 industries with separate outlets.

[c] Inorganic wastes.

[d] The Kansas State Board of Health has recommended that wastes from 5,800 people now connected to an existing primary treatment plant and from 13,200 people now discharged without treatment be connected to the secondary treatment plant to which additions are currently being made.



COLORADO
NEBRASKA
KANSAS
MISSOURI
N
HASTINGS
BEATRICE
CONCORDIA
CLAY CENTER
MANHATTAN
JUNCTION CITY
ABILENE
SALINA
HAYS
GOODLAND
HOLDREGE
YORK
TOPEKA
LAWRENCE
KANSAS CITY
OLATHE
KANSAS RIVER
MISSOURI RIVER
KANSAS RIVER BASIN
LOCATION MAP

KANSAS RIVER BASIN
GENERAL REFERENCE MAP

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO. 1

GENERAL DESCRIPTION

Historical Background

Prior to the coming of the white man, the lower Kansas River Valley was the home of the Kansa Indians; Kansa being a word meaning "wind people" or "people of the south wind." The Comanche Indians lived farther to the west along the headwater streams.

The first recorded visit of a white man to the area is that of Francisco Vasquez de Coronado, who reached central Kansas about 1540. His journey from Mexico occurred during his famous search for the seven cities of gold and ended at an Indian village located approximately on the present site of the City of Lindsborg on the Smoky Hill River. It is doubtful that Coronado ever saw the main Kansas River. Fifty years after his journey the region again was visited by two Spanish explorers who followed Coronado's route.

Early in the eighteenth century the French entered the region for the purpose of establishing trade with the Indians. Etienne de Bourgmont, a French officer and the first to record his explorations, traveled the river from its mouth to its source in the year 1724. Bourgmont later earned the title of Commandant of the Missouri River for his feats. Trading posts were established along the river by the French; among the early posts was one built on the present site of Bonner Springs, Kansas.

The first American credited with seeing the region was Daniel Boone, Jr., son of the famous frontiersman. Immediately following his visit, missions of various religious organizations established churches along the lower main stem. The region was formally opened to settlement when the Kansas-Nebraska Bill was passed in 1854. The next 10 years were a bloody decade for the Kansas Territory. Both slave holders and free holders attempted to gain control, and were utterly ruthless in their efforts. Murder, pillaging, and burning of property resulted. These were the days of John Brown, of Quantrill and his Red Leg Raiders.

The Kaw Valley was the scene of the great trails over which thousands of migrants began their trip westward to the California gold fields, to the southwest, and to the northwest. The Oregon Trail traversed the Basin, starting at Kansas City. Great herds of Texas Longhorn cattle traveled through the valley to railroad terminals en route to Kansas City for eastern markets. Later, transcontinental railroads and major highways were constructed along these routes.

The State of Kansas was organized in 1861; Nebraska became a State in 1867; and Colorado obtained Statehood in 1876. Following organization of the Territory of Kansas into States, the ending of the Civil War, and development of railroads, real settlement of the Kansas Basin began. Importation of rust and drought resistant wheat was the greatest single boon to agricultural development.

Physical Description

The Basin, rising from an elevation of 750 feet at its eastern terminus to 5,500 feet at its western end, lies in northeastern Colorado, southern Nebraska, and northern Kansas between the Platte and the Arkansas Rivers and encompasses an area of about 60,000 square miles. Approximately 60 percent is in Kansas, 24 percent in Nebraska, and 16 percent in Colorado (Map 1).

The Kansas River is comparatively short, flowing only 169 miles from its formation at the junction of the Smoky Hill and Republican Rivers to its mouth at Kansas City, Kansas. Major tributaries of the Smoky Hill include the Saline and Solomon Rivers. The Smoky Hill and its tributaries rise near the eastern boundary of the State of Colorado and flow eastward. The Republican rises in northeastern Colorado, flows eastward into Nebraska, and then southward into Kansas. The Big Blue rises in south central Nebraska and flows southward to join the Kansas near Manhattan, Kansas.

The eastern third of the Basin is a subhumid region while the western two-thirds is semiarid to arid. Discharges in the headwater streams are generally intermittent during the summer and early autumn months. Torrential rains occur in May, June, and July, and often produce devastating floods. Droughts are less frequent but are an ever-present possibility. Average annual precipitation over the Basin varies from approximately 15 inches in the western part to 36 inches in the eastern section. Characteristic of the inland plains, great extremes of temperature occur, varying from -38° to 115° F.

The slope of the Kansas River from Topeka to the mouth is 1.66 feet per mile and averages 1.9 feet per mile over its entire length. The headwaters streams gradually increase in gradient from mouth to source, and slope as much as 10 feet per mile in their upper reaches. Soils over much of the region are deep, fertile, and easily eroded. Streams generally carry large quantities of silt. Extremes of flow at the mouth of the Kansas River vary between 600 and 530,000 second-feet. Average flow for the period of record is about 8,000 second-feet. The lower main stem and the Republican River valleys have been most frequently hit by floods.

Economic Development

The economy is largely supported by agriculture. Approximately 85 percent of the area is under crop; wheat and livestock are the principal farm products. Large quantities of corn, potatoes, hay and other forage, are also grown. Drought-resistant wheat enables farmers in the western half of the Basin to grow large quantities of the cereal, even though rainfall is relatively sparse. Industry, centered in the larger municipalities, consists principally of meat packing, flour milling, and the processing of farm products. Municipalities also serve as transportation centers and distribution points for manufactured goods, particularly transportation and farm equipment.

The development of the oil industry in western Kansas adds greatly to the income of the region. Large refineries are located at Phillipsburg and Kansas City, Kansas.

Kansas City, Kansas, is the largest city and Topeka, the Capital of Kansas, is second in size. Other municipalities of note include Lawrence, Manhattan, Salina, Abilene, and Concordia, Kansas; York, Hastings, McCook, Beatrice, Fairbury and Crete, Nebraska; and Wray and Burlington, Colorado.

The population of municipalities is tabulated in table 2.

The Missouri Basin Development Program for land and water resource conservation, authorized in 1944, promises a new era in the Kansas Basin. Increased productivity brought about by irrigation, together with flood control, should be of particular benefit in stabilizing the Basin's economy.

Table 2. Kansas River Basin - Population of municipalities

Municipality	Population - U. S. Census		
	1930	1940	1950
Colorado			
Akron	1,135	1,417	1,605
Arriba	337	286	367
Burlington	1,280	1,880	2,247
Cheyenne Wells	595	695	1,154
Eckley	359	358	295
Flagler	540	506	793
Haxtun	1,027	985	1,006
Holyoke	1,226	1,150	1,558
Otis	529	498	532
Seibert	273	249	346
Stratton	507	623	720
Vona	183	226	209
Wray	1,785	2,061	2,198
Yuma	1,360	1,606	1,908
Kansas			
Abilene	5,658	5671	5,775
Agenda	185	179	159
Agra	408	406	354
Alma	811	776	716
Almena	703	543	616
Alta Vista	486	461	420
Alton	383	435	317
Assaria	201	232	221
Athol	280	248	203
Atwood	1,166	1,408	1,613
Aurora	256	274	221
Axtell	607	545	510
Barnard	416	306	282
Barnes	361	391	308
Beattie	434	389	321
Belleville	2,383	2,580	2,858
Beloit	3,502	3,765	4,085
Belvue	186	226	193
Bennington	374	369	325
Beverly	328	292	255
Bird City	740	694	784
Blue Rapids	1,465	1,433	1,430
Bogue	-	157	211
Bonner Springs	1,637	1,837	2,277
Brewster	487	408	467
Brookville	237	221	213
Bunker Hill	298	253	271
Burr Oak	595	560	505
Cawker City	739	657	691
Centralia	682	607	574
Chapman	819	782	990
Circleville	211	216	169
Clay Center	4,386	4,518	4,528
Clayton	226	153	157
Clifton	713	670	743
Clyde	1,174	1,060	1,067
Colby	2,153	2,458	3,859
Collyer	243	268	282
Concordia	5,792	6,255	7,175
Courtland	430	383	367
Cuba	403	363	345
Culver	206	195	153
Damar	-	263	305
Delia	269	222	164
Delphos	678	714	676
Denison	202	176	166
De Soto	384	383	518
Dorrance	325	414	365
Downs	1,383	1,219	1,321
Dresden	231	180	162
Easton	277	255	255
Edmond	197	180	110
Edwardsville	228	243	276
Effingham	646	676	525
Ellis	1,957	2,042	2,649
Ellsworth	2,072	2,227	2,193
Emmett	268	191	143
Enterprise	764	671	795
Esbon	319	292	278
Eudora	599	603	929
Everest	386	375	363
Frankfort	1,346	1,243	1,237
Formoso	381	293	271
Gaylord	291	245	231
Glasco	707	741	803
Glen Elder	617	555	582
Goff	437	339	315
Goodland	3,626	3,306	4,690
Gove	241	284	206
Grainfield	343	341	371
Green	293	246	219
Greenleaf	860	739	614
Grinnell	303	289	364
Gypsum	638	615	523
Haddam	381	364	375
Kansas (cont'd)			
Hanover	880	896	854
Havensville	263	232	208
Hays	4,618	6,385	8,625
Herington	4,519	3,804	3,775
Herndon	430	448	321
Hill City	1,027	1,115	1,432
Hollenburg	-	128	97
Holton	2,705	2,885	2,705
Hope	576	500	480
Horton	4,049	2,872	2,354
Hoxie	800	957	1,157
Irving	356	310	279
Jamestown	507	490	494
Jennings	344	311	330
Jewell	707	669	593
Junction City	7,407	8,507	13,370
Kanorado	355	322	285
Kanopolis	850	868	743
Kansas City	121,857	121,458	129,553
Kensington	546	597	635
Kirwin	500	392	374
Lawrence	13,726	14,390	23,351
Lebanon	723	652	610
Lecompton	288	290	263
Lenexa	452	502	803
Lenora	519	537	511
Leonardville	392	342	380
Liebenthal	-	265	211
Lincoln	1,738	1,761	1,636
Lindsborg	2,016	1,913	2,383
Linn	340	395	395
Linwood	295	299	261
Logan	743	703	859
Longford	200	160	178
Long Island	242	257	247
Louisville	227	188	190
Lucas	630	648	631
Luray	464	392	351
McCracken	594	534	553
McDonald	442	425	425
McFarland	-	336	279
McLouth	517	525	477
Mahaska	218	195	179
Manchester	241	215	151
Manhattan	10,136	11,659	19,056
Mankato	1,404	1,426	1,462
Maple Hill	-	247	176
Marquette	714	609	666
Marysville	4,013	4,055	3,866
Mayetta	294	275	247
Menlo	204	144	113
Meriden	390	421	378
Milford	300	271	284
Miltonvale	814	800	911
Minneapolis	1,741	2,087	1,801
Mission Woods	-	-	205
Morganville	281	264	278
Morland	385	356	287
Morrowville	248	308	229
Munden	205	193	169
Muscotah	365	331	248
Narka	252	193	220
Netawaka	229	226	213
New Cambria	-	144	160
Norcatur	524	440	368
Norton	2,767	2,762	3,060
Nortonville	606	562	568
Oak Hill	147	147	92
Oakley	1,159	1,138	1,915
Oberlin	1,629	1,878	2,019
Ogden	418	494	845
Okete	225	218	169
Olathe	3,656	3,979	5,593
Onaga	930	741	882
Osborne	1,881	1,876	2,068
Oskaloosa	733	800	721
Palco	290	276	405
Palmer	187	182	150
Paradise	178	161	145
Park	-	-	223
Paxico	261	237	196
Perry	418	392	399
Phillipsburg	1,543	2,109	2,589
Plainville	1,058	1,232	2,082
Portis	340	349	286
Powhattan	221	184	150
Prairie View	198	205	192
Prairie Village	-	-	9,229
Quinter	570	481	741
Ramona	240	236	190

Table 2. Kansas River basin - Population of municipalities (Cont'd)

Municipality	Population - U. S. Census 1930	1940	1950
Kansas (cont'd)			
Randall	262	241	240
Randolph	408	369	391
Republic	396	378	360
Reserve	197	172	169
Rexford	375	244	304
Riley	431	392	414
Rossville	701	601	577
Russell	2,352	4,819	6,483
Russell Springs	141	198	161
St. Francis	944	1,041	1,592
St. George	216	203	251
St. Marys	1,304	1,132	1,201
Sabetha	2,332	2,241	2,173
Salina	20,155	21,073	26,176
Scandia	608	614	611
Schoenchen	-	259	170
Scottsville	169	187	108
Selden	399	401	438
Sharon Springs	792	760	994
Shawnee	553	597	845
Silver Lake	336	362	331
Simpson	273	235	234
Smith Center	1,736	1,686	2,026
Soldier	274	247	193
Solomon	1,032	872	834
Speed	139	111	70
Stockton	1,291	1,418	1,867
Summerfield	398	396	305
Sunflower Village	-	-	3,834
Sylvan Grove	540	477	506
Tescott	382	402	412
Tipton	294	246	246
Tonganoxie	1,109	1,114	1,138
Topeka	64,120	67,833	78,791
Utica	382	379	365
Valley Falls	1,236	1,241	1,139
Vermillion	288	300	283
Victoria	637	884	988
Vining	198	185	168
Wakeeney	1,408	1,852	2,446
Wakefield	528	513	591
Waldo	279	257	216
Wallace	-	102	111
Wamego	1,647	1,767	1,869
Washington	1,370	1,598	1,527
Waterville	698	717	676
Westmoreland	501	532	416
Westwood	-	-	1,581
Wheaton	170	155	134
White City	619	516	540
Whiting	351	343	267
Willis	217	160	140
Wilson	1,038	1,068	1,039
Winchester	413	415	355
Winona	324	317	382
Woodbine	317	212	195
Woodston	287	286	298
Zurich	-	-	186
Nebraska			
Alexandria	421	369	317
Alma	1,235	1,272	1,768
Arapahoe	1,017	1,002	1,226
Aurora	2,715	2,419	2,455
Axtell	328	255	352
Barneston	221	219	208
Bartley	465	380	399
Beatrice	10,297	10,883	11,813
Beaver City	1,024	1,015	1,015
Beaver Crossing	522	550	425
Belvidere	358	325	274
Benedict	279	221	206
Benkelman	1,154	1,448	1,512
Bladen	448	272	282
Bloomington	431	361	293
Blue Hill	669	565	574
Blue Springs	700	681	581
Bradshaw	340	339	352
Bruning	316	232	246
Cambridge	1,203	1,084	1,352
Campbell	565	478	412
Carleton	363	350	291
Chester	579	634	539
Clay Center	933	715	824
Cortland	318	307	288
Cowles	224	158	130
Crete	2,865	3,038	3,692
Culbertson	820	815	770
Curtis	960	752	984
Danbury	321	236	218
Davenport	477	490	459
David City	2,333	2,272	2,321
Deshler	1,177	1,037	1,063
Diller	405	378	314
De Witt	534	490	528
Nebraska (cont'd)			
Dorchester	579	558	478
Edgar	987	708	724
Elsie	262	223	219
Elwood	509	633	562
Endicott	242	246	195
Exeter	941	841	747
Fairbury	6,192	6,304	6,395
Fairfield	757	640	503
Fairmont	760	810	729
Franklin	1,103	1,272	1,602
Friend	1,214	1,169	1,148
Geneva	1,662	1,888	2,031
Giltner	355	325	264
Glenville	376	285	281
Grafton	284	240	159
Grant	798	897	1,091
Gresham	442	352	257
Guide Rock	690	596	676
Haigler	535	507	398
Hamlet	199	220	154
Hampton	369	310	283
Hardy	399	341	348
Harvard	865	704	774
Hastings	15,490	15,145	20,211
Hayes Center	229	314	361
Hebron	1,804	1,909	2,000
Henderson	480	495	536
Hildreth	400	361	374
Holbrook	488	441	398
Holdrege	3,263	3,360	4,381
Holstein	294	241	187
Hubbell	233	250	199
Huntley	179	148	98
Imperial	946	1,195	1,563
Indianola	815	800	738
Jansen	264	255	244
Juniata	367	338	365
Kenesaw	614	551	586
Lawrence	528	445	376
Lebanon	262	238	213
Liberty	348	340	246
Loomis	213	249	218
McCook	6,688	6,212	7,678
McCool Junction	356	272	297
Madrid	449	410	379
Maywood	525	426	409
Milford	832	759	951
Milligan	412	392	367
Minden	1,716	1,846	2,120
Naponee	252	272	391
Nelson	903	963	806
Odell	472	404	420
Ohiowa	394	326	253
Orleans	985	815	956
Osceola	1,054	1,039	1,098
Oxford	1,155	1,141	1,270
Palisade	731	799	694
Plymouth	418	434	348
Polk	532	493	508
Red Cloud	1,519	1,610	1,744
Republican City	417	331	584
Reynolds	213	211	166
Rising City	472	420	378
Riverton	328	390	348
Ruskin	239	223	214
Seward	2,737	2,826	3,154
Shelby	630	627	624
Shickley	389	432	316
Stamford	297	260	265
Staplehurst	254	234	224
Steele City	295	291	214
Stockville	186	238	181
Stratton	663	630	628
Stromsburg	1,320	1,127	1,231
Superior	3,044	2,650	3,227
Surprise	257	228	120
Sutton	1,540	1,403	1,353
Swanton	238	233	203
Tobias	402	316	240
Trenton	865	920	1,239
Ulysses	492	429	274
Upland	387	317	251
Utica	566	539	550
Venango	286	214	233
Waco	266	203	180
Wallace	406	335	361
Wauneta	793	770	926
Western	511	437	434
Wilber	1,352	1,355	1,356
Wilcox	343	310	296
Wilsonville	489	382	327
Wymore	2,680	2,457	2,298
York	5,712	5,383	6,178

USES OF WATER RESOURCES

There was little development of water resources in the Kansas Basin prior to inauguration of the Missouri River Basin Development Program. Stream discharges for the most part were so erratic that development depending on stabilized flows was impossible. Of the 310 municipal water supplies of the Basin only 12 , or 4 percent serving 12 percent of the population, are obtained from surface sources. Surface water is used to serve power plants at Topeka and Lawrence; for processing purposes at Sunflower Ordnance Depot; and for miscellaneous industries in Kansas City, Kansas. Lack of suitable sites has retarded hydroelectric power development although at one time there were 41 small units; the largest of these being the Rocky Ford Plant on the Blue River near Manhattan, the milling company plant at Lawrence, and the installation at Marysville.

Prior to 1951 irrigation was practiced mainly in the headwater sections of the Republican River along Frenchman Creek and the North Fork of the Republican. Here, water was pumped from ground sources or diverted from the streams. Enders and Medicine Creek Reservoirs, on Frenchman Creek and Medicine Creek respectively, permit irrigation along the Republican River from McCook to Orleans, Nebraska, and development of these irrigation lands is progressing rapidly. Irrigation of the Bostwick Unit, below Harlan County Dam, will become a reality as canals now under construction are completed. Other areas considered suitable for irrigation lie below Trenton Dam along the Republican River and Kanopolis and Cedar Bluffs Dams along the Smoky Hill River, along the Saline River below proposed Wilson Reservoir, along the Solomon River below proposed Kirwin, Webster, and Glen Elder Reservoirs, and below Bonny Dam on the South Fork of the Republican. The reservoirs that have been completed or are now near completion include Bonny near Burlington, Colorado; Enders at Imperial, Nebraska; Medicine Creek near Cambridge, Nebraska; Harlan County at Alma, Nebraska; Kanopolis near Kanopolis, Kansas; and Cedar Bluffs near Hays, Kansas. Construction of Kirwin Reservoir began this year. These reservoirs have created much needed fishing, boating, and swimming areas, their popularity being attested by the large numbers of people that have visited them since their completion. Stabilization of stream flows will permit greater development of fishery and recreational use, alleviate pollution, and allow greater development of domestic and industrial water supply than has been previously possible. The operating plan for Harlan County Reservoir provides flows for the next 20 years in the Republican River below the dam sufficient to assimilate the residual organic material from primary treatment of sewage.

Present uses of water resources are depicted on map No. 2. Table 3 lists municipalities deriving their public water supply from ground sources, and table 4 lists those securing water from surface sources. Industrial use of water is exceedingly heavy in the lower Kansas River. Production at the Sunflower Ordnance Plant is dependent upon an adequate volume of clean water. One plant, located about three miles above Superior, Nebraska, and engaged in the manufacture of Portland Cement, has water rights to 11.5 second-feet.

Table 3. Kansas River Basin - Municipal Water Supplies From Ground Sources

Municipality	Source (1)	Treatment (2)	Population Served	Average Consumption M.G.D.
Kansas				
Abilene	SW	D	5,600	0.70
Agenda	DW	D	430	0.03
Agra	SW	N	280	0.03
Alma	SW	N	700	0.07
Almena	SW	N	576	0.15
Alta Vista	DW	N	400	0.07
Alton	SW	N	270	0.04
Assaria	SW	N	210	0.02
Atwood	SW	D	1,400	0.30
Aurora	DW	D	160	0.01
Axtell	SW	N	490	0.06
Barnard	SW	N	240	0.01
Barnes	DW	N	280	0.02
Beattie	SW	Dp	280	0.01
Belleville	DW	D	2,700	0.31
Bennington	SW	Dp	320	0.03
Bird City	DW	N	630	0.08
Blue Rapids	SW	D	1,250	0.10
Bogue	SW	D	210	0.02
Bonner Springs	SW	ID	2,900	0.12
Brewster	DW	N	438	0.02
Brownell	SW	D	150	0.02
Brookville	SW	N	160	0.01
Bunker Hill	DW	Dp	180	0.02
Burr Oak	SW	D	480	0.02
Cawker City	SW	D	640	0.06
Centralia	SW	N	460	0.02
Chapman	SW	D	850	0.10
Circleville	SW	D	150	0.01
Clay Center	SW	Dp	4,000	0.60
Clayton	SW	N	110	0.02
Clifton	SW	D	520	0.08
Clyde	DW	HFD	1,045	0.18
Colby	DW	N	3,360	0.35
Collyer	DW	N	160	0.03
Concordia	DW, SW	Dp	6,775	0.92
Courtland	SW	D	260	0.02
Cuba	DW	N	330	0.01

Table 3. Kansas River Basin - Municipal Water Supplies From Ground Sources(cont'd)

Municipality	Source (1)	Treatment (2)	Population Served	Average Consumption M.G.D.
Kansas (cont'd)				
Damar	SW	N	175	0.01
Delia	SW	D	150	0.01
Delphos	SW	D	720	0.13
Dennison	SW	D	106	0.01
De Soto	SW	DIH	500	0.03
Downs	SW	N	1,250	0.25
Easton	SW	DF	200	0.02
Edgerton	SW	D	300	0.01
Effingham	DW	N	330	0.04
Ellis	SW	D	1,840	0.30
Ellsworth	SW	Dp	2,200	0.40
Emmett	SW	D	120	0.01
Enterprise	SW	DH	810	0.10
Eskridge	SW	D	550	0.03
Esbon	SW	N	120	0.01
Eudora	SW	FDI	795	0.05
Everest	SW	D	220	0.01
Formoso	SW	N	200	0.01
Fort Riley	W	D	13,000	2.10
Frankfort	DW	D	1,250	0.14
Gaylord	SW	D	240	0.05
Glasco	SW	N	750	0.06
Glen Elder	SW	N	480	0.03
Goff	SW	D	200	0.01
Goodland	DW	D	5,000	0.75
Gove	SW	D	200	0.02
Grainfield	DW	N	190	0.03
Green	DW	Dp	170	0.01
Greenleaf	SW	D	610	0.07
Grinnell	DW	N	210	0.01
Gypsum	SW	N	550	0.03
Haddam	SW	D	370	0.02
Hanover	SW	Hf	600	0.05
Havensville	SW	N	210	0.01
Hays	SW	D	6,400	0.75
Herndon	SW	D	320	0.08
Hill City	SW	D	1,150	0.43
Holton*	SP,SW	D	2,650	0.20
Hope	SW	N	320	0.02
Hoxie	SW	N	1,090	0.45

Table 3. Kansas River Basin - Municipal Water Supplied From Ground Sources (cont'd)

Municipality	Source (1)	Treatment (2)	Population Served	Average Consumption M.G.D.
Kansas (cont'd)				
Hoyt	SW	D	200	0.01
Hunter	SW	N	120	0.01
Idana	SW	D	80	0.01
Irving	SW	Dp	260	0.01
Jamestown	DW	N	460	0.06
Jennings	SW	N	260	0.03
Jewell	SW	F	610	0.04
Junction City	SW	DFH	10,900	1.64
Kanopolis	SW	Dp	670	0.07
Kanorado	DW	N	260	0.04
Kensington	SW	Dp	570	0.06
Kirwin	SW	D	370	0.04
Lebanon	SW	N	510	0.06
Lecompton	SW	DS	150	0.01
Lenora	SW	N	480	0.04
Leonardville	DW	N	280	0.03
Lincoln	SW	SFD	1,800	0.28
Lindsborg	SW	N	1,900	0.30
Linn	SW	DI	330	0.02
Linwood	SW		300	0.01
Logan	SW	N	1,050	0.20
Longford	DW,SW	N	120	0.01
Long Island	SW	Dp	220	0.01
Lucas	SP,SW	N	370	0.05
Luray	SW	D	340	0.04
McCracken	SW	D	480	0.04
McDonald	DW	N	400	0.03
McLouth	SP	N	350	0.01
Mahaska	DW	N	190	0.01
Manchester	SW	N	140	0.01
Manhattan	SW	FDHI	21,375(3)	2.6
Mankato	SW	D	1,450	0.10
Maple Hill	SW	D	190	0.01
Marquette	SW	N	600	0.06
Meriden	SW	D	550	0.02
Milford	SW	N	150	0.01
Miltonvale	SW	N	700	0.07
Minneapolis	SW,DW	D	2,057	0.20
Morganville	SW	D	160	0.03
Morrowville	SW	D	210	0.01
Munden	SW	N	140	0.01

Table 3. Kansas River Basin - Municipal Water Supplies From Ground Sources (cont'd)

Municipality	Source (1)	Treatment (2)	Population Served	Average Consumption M.G.D.
Kansas (cont'd)				
Muscotah	DW	D	200	0.01
Narka	DW	N	160	0.01
Natoma	SW	N	620	0.06
Norcatur	DW	N	320	0.03
Norton	SW	D	3,400	0.35
Nortonville	DW	N	440	0.02
Oakley	DW	N	1,650	0.40
Oberlin	SW	N	2,000	0.30
Ogden	SW	N	400	0.05
Oketo	SW	N	130	0.01
Oldsburg	DW	D	130	0.01
Oskaloosa	SW	D	340	0.02
Palco	SW	N	280	0.02
Palmer	SW	N	120	0.01
Paradise	SW	N	95	0.01
Paxico	SW	D	275	0.02
Perry	DW	DHFI	250	0.03
Phillipsburg	SW	ID	2,340	0.32
Plainville	SW	N	1,510	0.19
Portis	SW	N	240	0.02
Prairie View	SW	N	170	0.01
Quinter	DW	N	560	0.04
Randall	SW	N	220	0.01
Randolph	SW	D	350	0.02
Republic	SW	N	320	0.01
Rexford	DW	N	250	0.02
Riley	DW	D	350	0.02
Rossville	SW	DF	350	0.02
St. Francis	SW	Dp	1,500	0.32
St. Marys	SW	D	1,200	0.12
Salina	SW	D	23,000	4.50
Scandia	SW	N	550	0.04
Selden	DW	N	380	0.02
Sharon Springs	SW	D	980	0.16
Silver Lake	SW	N	100	0.01
Simpson	SW	N	220	0.02
Smith Center	SW	ID	1,700	0.25
Solomon	SW	N	789	0.04
Speed	SW	N	70	0.02

Table 3. Kansas River Basin - Municipal water supplies from ground sources (Cont'd)

Municipality	Source (1)	Treatment (2)	Population Served	Average Consumption M.G.D.
Kansas (Cont'd)				
Stockton	SW	N	1,800	0.27
Summerfield	SW	N	100	0.01
Sunflower	SW	FDS	5,400	[illegible]
Sylvan Grove	SW	N	450	0.08
Tescott	SW	N	300	0.02
Tipton	SW	N	190	0.01
Tonganoxie	SW	DS	900	0.20
Utica	SW,DW	N	310	0.03
Valley Falls	SP,SW	N	1,300	0.125
Vermillion	SW	D	110	0.01
Victoria	SW	N	600	0.03
WaKeeney	SW	D	1,800	0.25
Wakefield	SW	Dp	500	0.08
Waldo	SW	D	200	0.04
Wallace	SW	N	110	0.01
Wamego	SW	D	1,786	0.28
Waterville	SW	N	650	0.07
Westmoreland	SW	D	400	0.03
Wetmore	SW	D	250	0.04
White City	* DW	N	450	0.02
Wilson	SW	D	1,180	0.21
Winchester	SP	N	240	0.01
Winona	SW	N	320	0.01
Woodston	SW	N	280	0.01

* Holton - impoundment also serves as source of water supply.

(1) Source
  W-Wells
  SW-Shallow Wells
  DW-Deep wells
  SP-Springs

(2) Treatment
  N-None
  D-Chlorinated
  DP-Partially chlorinated
  F-Coagulated, settled, filtered
  I-Iron removal
  S-Softened

(3) Including 7,500 Kansas State College students.

Table 3. Kansas River Basin - Municipal water supplies from ground sources

Municipality	Source (1)	Treatment (2)	Population served	Average consumption M. G. D.
Colorado				
Akron	W	D	2,000	0.35
Burlington	DW	N	2,500	0.30
Cheyenne Wells	DW	N	850	0.12
Eckley	DW	N	300	0.03
Flagler	W	N	570	0.06
Haxtun	DW	N	1,200	0.25
Holyoke	DW	N	1,340	0.35
Otis	W	N	500	0.06
Seibert	W	N	250	0.01
Stratton	W	D	720	0.06
Vona	W	N	200	0.02
Wray	DW	N	3,000	0.30
Yuma	W	N	2,000	0.20
Kansas				
Abilene	SW	D	5,600	0.70
Agra	SW	N	280	0.03
Alma	SW	N	700	0.07
Almena	SW	N	576	0.15
Alta Vista	DW	N	400	0.07
Alton	SW	N	270	0.04
Assaria	SW	N	210	0.02
Atwood	SW	D	1,400	0.30
Aurora	DW	D	160	0.01
Axtell	SW	N	490	0.06
Barnard	SW	N	240	0.01
Barnes	DW	N	280	0.02
Beattie	SW	Dp	280	0.01
Belleville	DW	D	2,700	0.31
Bennington	SW	Dp	320	0.03
Bird City	DW	N	630	0.08
Blue Rapids	SW	D	1,250	0.10
Bogue	SW	D	210	0.02
Bonner Springs	SW	ID	2,900	0.12
Brewster	DW	N	438	0.02
Brookville	SW	N	160	0.01
Bunker Hill	DW	Dp	180	0.02
Burr Oak	SW	D	480	0.02
Cawker City	SW	D	640	0.06
Centralia	SW	N	460	0.02
Chapman	SW	D	850	0.10
Clay Center	SW	Dp	4,000	0.60
Clayton	SW	N	110	0.02
Clifton	SW	D	520	0.08
Clyde	DW	HFD	1,045	0.18
Colby	DW	N	3,560	0.35
Collyer	DW	N	160	0.03
Concordia	DW,SW	Dp	6,775	0.92
Courtland	SW	D	260	0.02
Cuba	DW	N	330	0.01
Damar	SW	N	175	0.01
Delphos	SW	D	720	0.13
De Soto	SW	DIN	500	0.03
Downs	SW	N	1,250	0.25
Effingham	DW	N	330	0.04
Ellis	SW	D	1,640	0.30
Ellsworth	SW	Dp	2,200	0.40
Enterprise	SW	DN	610	0.10
Esbon	SW	N	120	0.01
Eudora	SW	FDI	795	0.05
Everest	SW	D	220	0.01
Formoso	SW	N	200	0.01
Fort Riley	W	D	13,000	2.10
Frankfort	DW	D	1,250	0.14
Gaylord	SW	D	240	0.05
Glasco	SW	N	750	0.06
Glen Elder	SW	N	480	0.03
Goff	SW	D	200	0.01
Goodland	DW	D	5,000	0.75
Gove	SW	N	24	0.01
Grainfield	DW	N	190	0.03
Green	DW	Dp	170	0.01
Greenleaf	SW	D	610	0.07
Grinnell	DW	N	210	0.01
Gypsum	SW	N	550	0.03
Haddam	SW	D	370	0.02
Hanover	SW	NP	600	0.05
Havensville	SW	N	210	0.01
Hays	SW	D	6,400	0.75
Herndon	SW	D	320	0.08
Kansas (cont'd)				
Hill City	SW	D	1,150	0.43
Holton*	SP,SW	D	2,650	0.20
Hope	SW	N	320	0.02
Hoxie	SW	N	1,090	0.45
Hunter	SW	N	120	0.01
Irving	SW	Dp	260	0.01
Jamestown	DW	N	460	0.06
Jennings	SW	N	260	0.03
Jewell	SW	N	610	0.04
Junction City	SW	DFN	10,900	1.64
Kanopolis	SW	Dp	670	0.07
Kanorado	DW	N	250	0.04
Kensington	SW	Dp	570	0.06
Kirwin	SW	D	370	0.04
Lebanon	SW	N	510	0.04
Lenora	SW	N	480	0.04
Leonardville	DW	N	280	0.03
Lincoln	SW	HFD	1,600	0.28
Lindsborg	SW	N	1,900	0.30
Linn	SW	DI	330	0.02
Logan	SW	N	1,050	0.20
Longford	DW,SW	N	120	0.01
Long Island	SW	Dp	220	0.01
Lucas	SP,SW	N	570	0.05
Luray	SW	D	340	0.04
McCracken	SW	D	480	0.04
McDonald	DW	N	400	0.03
McLouth	SP	N	350	0.01
Mahaska	DW	N	190	0.01
Manchester	SW	N	140	0.01
Manhatten	SW	FDNI	21,375(3)	2.6
Mankato	SW	D	1,450	0.10
Marquette	SW	N	600	0.06
Milford	SW	N	150	0.01
Miltonvale	SW	N	700	0.07
Minneapolis	SW,DW	D	2,057	0.20
Morganville	SW	D	160	0.03
Morrowville	SW	D	210	0.01
Munden	SW	N	140	0.01
Narka	DW	N	160	0.01
Natoma	SW	N	620	0.06
Norcatur	DW	N	320	0.05
Norton	SW	D	3,400	0.35
Nortonville	DW	N	440	0.02
Oakley	DW	N	1,650	0.40
Oberlin	SW	N	2,000	0.30
Ogden	SW	N	400	0.05
Oketo	SW	N	130	0.01
Oskaloosa	SW	D	540	0.02
Palco	SW	N	280	0.02
Palmer	SW	N	120	0.01
Paradise	SW	N	95	0.01
Perry	DW	DNFI	250	0.03
Phillipsburg	SW	ID	2,340	0.32
Plainville	SW	N	1,510	0.19
Portis	SW	N	240	0.02
Prairie View	SW	N	170	0.01
Quinter	DW	N	560	0.04
Randall	SW	N	220	0.01
Randolph	SW	D	350	0.02
Republic	SW	N	320	0.01
Rexford	DW	N	250	0.02
Riley	DW	D	350	0.02
Roseville	SW	NP	350	0.02
St. Francis	SW	Dp	1,500	0.32
St. Marys	SW	D	1,200	0.12
Salina	SW	D	23,000	4.50
Scandia	SW	N	550	0.04
Selden	DW	N	330	0.02
Sharon Springs	SW	D	940	0.16
Silver Lake	SW	N	100	0.01
Simpson	SW	N	220	0.02
Smith Center	SW	ID	1,700	0.25
Solomon	SW	N	783	0.04
Speed	SW	N	70	0.02
Stockton	SW	N	1,800	0.27
Summerfield	SW	N	100	0.01
Sunflower	SW	FDN	5,400	1.00
Sylvan Grove	SW	N	450	0.08
Tescott	SW	N	300	0.02

4495
LIBRARY
SANITARY ENGINEERING CENTER
CINCINNATI, OHIO

Table 3. Kansas River Basin - Municipal water supplies from ground sourc_ (Cont'd)

Municipality	Source (1)	Treatment (2)	Population served	Average consumption M. G. D.
Kansas (cont'd)				
Tipton	SW	N	190	0.01
Tonganoxie	SW	DH	900	0.20
Utica	SW,DW	N	310	0.03
Valley Falls	SP,SW	N	1,300	0.125
Vermillion	SW	D	110	0.01
Victoria	SW	N	600	0.05
Wakeeney	SW	D	1,800	0.25
Wakefield	SW	Dp	500	0.08
Waldo	SW	D	200	0.04
Wallace	SW	N	110	0.01
Wamego	SW	D	1,786	0.28
Waterville	SW	N	650	0.07
Westmoreland	SW	D	400	0.03
White City	DW	N	450	0.02
Wilson	SW	D	1,180	0.21
Winchester	SP	N	240	0.01
Winona	SW	N	320	0.01
Woodston	SW	N	280	0.01
Nebraska				
Alexandria	W	N	350	0.03
Alma	DW	N	1,800	0.30
Arapahoe	W	N	1,050	0.20
Atlanta	DW	N	100	0.01
Aurora	DW	N	2,400	0.09
Axtell	DW	N	250	0.03
Bartley	W	N	200	0.02
Beatrice	W	N	10,000	1.60
Beatrice State Home	W	N	2,000	0.20
Beaver City	W	N	1,090	0.40
Beaver Crossing	DW	N	330	0.10
Belvidere	W	N	260	0.06
Benedict	DW	N	200	0.03
Benkelman	W	N	1,600	0.20
Bertrand	DW	N	500	0.20
Bladen	DW	N	250	0.08
Bloomington	W	N	250	0.10
Blue Hill	DW	N	500	0.04
Blue Springs	Wymore	N	650	0.05
Bradshaw	DW	N	270	0.02
Bruning	W	N	185	0.02
Burchard	W	N	160	0.02
Cambridge	W	N	950	0.30
Campbell	DW	N	400	0.20
Carleton	W	N	300	0.10
Chester	W	N	580	0.40
Clatonia	DW	N	150	0.02
Clay Center	W	N	830	0.30
Cortland	DW	N	250	0.02
Crete	DW	N	2,500	2.00
Culbertson	W	N	700	0.06
Curtis	"	N	900	0.05
Danbury	W	N	235	0.04
Davenport	W	N	390	0.03
David City	DW	N	2,600	0.40
Deshler	DW	N	1,200	0.10
DeWitt	W	N	430	0.05
Diller	W	N	320	0.04
Dorchester	DW	N	575	0.15
Edgar	DW	N	800	0.15
Edison	W	N	250	0.01
Elsie	DW	N	190	0.02
Elwood	DW	N	510	0.03
Eustis	DW	N	400	0.15
Exeter	W	N	800	0.10
Fairbury	SP,SW	HD	8,000	1.00
Fairfield	W	N	525	0.18
Fairmont	DW	N	800	0.25
Franklin	W	N	1,600	0.30
Friend	DW	N	1,000	0.20
Nebraska (cont'd)				
Geneva	W	N	1,700	0.40
Giltner	DW	N	230	0.02
Glenville	DW	N	250	0.03
Grafton	DW	N	170	0.015
Grant	DW	N	800	0.20
Gresham	DW	N	300	0.09
Haigler	W	N	480	0.03
Hampton	DW	N	280	0.03
Hardy	W	N	200	0.06
Harvard	DW	N	1,450	0.10
Hastings	DW	N	21,000	4.00
Hayes Center	DW	N	200	0.05
Hebron	DW	N	2,000	0.15
Henderson	DW	N	370	0.02
Hildreth	DW	N	290	0.02
Holbrook	W	N	440	0.02
Holdredge	DW	N	4,800	0.80
Hubbell	W	N	200	0.02
Imperial	DW	N	1,390	0.10
Indianola	W	N	800	0.05
Ingleside	W	N	2,000	0.20
Jansen	DW	N	185	0.005
Kenesaw	DW	N	500	0.10
Lawrence	DW	N	360	0.05
Liberty	W	N	170	0.01
Loomis	DW	N	200	0.02
McCook	W	D	8,500	1.00
Madrid	DW	N	350	0.008
Maywood	W	N	250	0.03
Milford	W	N	1,200	0.10
Milligan	DW	N	330	0.025
Minden	DW	N	1,600	0.10
Naponee	W	N	200	0.02
Odell	W	N	300	0.009
Ohiowa	W	N	280	0.01
Orleans	W	N	900	0.05
Osceola	DW	N	950	0.20
Oxford	W	N	1,000	0.10
Palisade	W	N	700	0.05
Plymouth	DW	N	350	0.008
Polk	DW	N	400	0.01
Red Cloud	W	N	1,500	0.20
Republican City	DW	N	250	0.01
Rising City	DW	N	340	0.015
Riverton	W	N	250	0.01
Ruskin	W	N	170	0.02
Seward	W	N	2,900	0.20
Shelby	DW	N	500	0.05
Shickley	DW	N	300	0.02
Stamford	W	N	230	0.02
Staplehurst	W	N	200	0.03
Stockville	W	N	200	0.015
Stratton	W	N	600	0.18
Stromsburg	W	HF	1,350	0.20
Superior	W	HFD	3,000	0.40
Sutton	W	N	1,300	0.10
Swanton	W	N	180	0.015
Tobias	W	N	300	0.015
Trenton	W	N	850	0.05
Trumbull	DW	N	100	0.007
Ulysses	W	N	425	0.06
Upland	DW	N	300	0.01
Utica	DW	N	500	0.04
Venango	DW	N	214	0.02
Waco	DW	N	200	0.025
Wauneta	W	N	800	0.07
Western	DW	N	400	0.04
Wilber	W	N	1,250	0.17
Wilcox	DW	N	290	0.03
Wilsonville	W	N	350	0.035
Wymore	W	N	3,000	0.90
York	W	N	6,200	0.50
Totals -	Supplies 298		355,954	52.102

*Holton - Impoundment also serves as source of water supply.

(1) Source -
W - Wells
SW - Shallow wells
DW - Deep Wells
SP - Springs

(2) Treatment -
N - None
D - Chlorinated
Dp - Partially chlorinated
F - Coagulated, settled, filtered
I - Iron removal
H - Softened

(3) Including 7,500 Kansas State College students.

A

Table 4. Kansas River Unit - Municipal Water Supplies from Surface Sources

City	Population 1956	Population Served 1956	Date Operation Started	Source of Supply	Rated Plant Capacity MGD*	Wa 19 Av
Beloit	4,000	4,000	---	Solomon River	---	0.
Carbondale	521	250	1953	Lake & Shallow well	0.04	0.
Herington	3,700	3,700	---	Lyons Creek	---	0.
Holton	2,900	2,600	1907	Imp., Springs & shallow wells	0.52	0.
Horton	2,800	2,800	1893	Impoundment	1.27	0.
Kansas City	128,000	160,900	1883	Missouri River	50.0	26.
Lawrence	22,550	20,000	1887	Kansas River & shallow wells	7.0	3.
Lenexa	1,300	1,000	1937	Kansas City, Mo.	0.36	0.
Marysville	4,100	4,000	1903	Big Blue River	1.25	0
Olathe	8,000	7,500	1885	City Lakes	1.5	0
Olathe NAS	3,000	3,000		Gardner Lake	0.60	0
Onaga	850	800	1911	Vermillion River, Hise Creek, shallow wells	0.14	0

B

plies from Surface Sources

te eration erted	Source of Supply	Rated Plant Capacity MGD*	Water Use 1956 - MGD*		Estimated Water Use 1975 - MGD*		Water Treatment
			Avg.	Max.	Avg.	Max.	
--	Solomon River	---	0.430	--	---	---	Coagulated, settled, filtered, chlorinated, softened.
53	Lake & Shallow well	0.04	0.005	0.01	0.07	0.15	Slow sand filtration and chlorination.
--	Lyons Creek	---	0.55	---	---	---	Coagulated, settled, filtered, chlorinated
07	Imp., Springs & shallow wells	0.52	0.19	0.45	0.30	0.60	Chlorination, coagulation, sedimentation, softening and filtration
93	Impoundment	1.27	0.25	0.55	0.35	0.75	Aeration, chlorination, softening, sedimentation, filtration fluoridation.
83	Missouri River	50.0	26.0	50.0	41.0	59.0	Sedimentation, chlorination, coagulation, sedimentation and filtration.
07	Kansas River & shallow wells	7.0	3.0	5.0	4.5	9.5	Sedimentation, chlorination, softening, sedimentation, filtration, fluoridation.
37	Kansas City, Mo.	0.36	0.09	0.14	0.24	0.36	
03	Big Blue River	1.25	0.35	0.80	0.70	1.25	Coagulation, sedimentation, filtration and chlorination.
85	City Lakes	1.5	0.45	0.85	2.5	3.2	Chlorination, coagulation, sedimentation & filtration.
	Gardner Lake	0.60	0.37	0.8	0.5	1.0	Aeration, chlorination, coagulation, sedimentation, filtration.
11	Vermillion River, Hise Creek, shallow wells	0.14	0.07	0.11	0.09	0.14	Aeration, chlorination and sedimentation.

A

Table 4 Cont'd. Kansas River Unit - Municipal Water Supplies from Surface Sources

City	Population 1956	Population Served 1956	Date Operation Started	Source of Supply	Rated Plant Capacity MGD*	Wate 1956 Avg
Osborne	1,962	1,962	---	S. Fork Solomon River	---	0.3
Oskaloosa	730	650	1916	Imp. & shallow wells	0.13	0.03
Russell	6,555	6,600	---	Imp.-Fossill Cr. & Cedar Bluff Res.	---	1.0
Sabetha	2,350	2,000	1910	Impoundment	0.62	0.3
Topeka	85,700	122,000	1881	Kansas River	16.0	12.8
Valley Falls	1,150	1,100	1888	Delaware River springs & shallow wells	0.33	0.1
Washington	1,600	1,470	1901	Mill Creek	0.86	0.2

* Million Gallons per day.

Water Supplies from Surface Sources

Date Operation Started	Source of Supply	Rated Plant Capacity MGD*	Water Use 1956 - MGD* Avg.	Water Use 1956 - MGD* Max.	Estimated Water Use 1975 -MGD* Avg.	Estimated Water Use 1975 -MGD* Max.	Water Treatment
---	S. Fork Solomon River	---	0.30	---	---	---	Coagulated, settled, filtered, and chlorinated.
1916	Imp. & shallow wells	0.13	0.03	0.04	0.05	0.08	Chlorination, coagulation, sedimentation & filtration
---	Imp.-Fossill Cr. & Cedar Bluff Res.	---	1.00	---	---	---	Coagulated, settled, filtered, chlorinated, softened.
1910	Impoundment	0.62	0.30	0.60	0.40	0.80	Aeration, chlorination, Coagulation, sedimentation and filtration.
1881	Kansas River	16.0	12.88	23.00	27.0	50.0	Chlorination, sedimentation, softening, sedimentation, filtration, fluoridation.
1888	Delaware River springs & shallow wells	0.33	0.10	0.15	0.2	0.4	Chlorination, coagulation, sedimentation, filtration
1901	Mill Creek	0.86	0.25	0.68	0.38	0.93	Aeration, sedimentation, chlorination, coagulation, sedimentation, filtration.

Table 4. Kansas River Basin - Municipal surface water supplies

Stream and municipality	State	Approximate miles above mouth		Treatment (1)	Population served	Average consumption M.G.D.
		Kansas River	Tributary			
Kansas River						
Smoky Hill River		169.2				
Fossil Creek			282.1			
Russell[2]	Kansas		7.0	FDH	5,800	0.46
Solomon River			85.4			
S.Fork Solomon R.			171.6			
Osborne[3]	Kansas		26.1	FD	1,800	0.20
Beloit	Kansas		130.6	FDH	4,260	0.33
Lyons Creek			14.0			
Herington	Kansas		37.0	FD	3,700	0.40
Big Blue River		142.5				
Marysville	Kansas		80.0	FD	4,000	0.65
Little Blue River			61.8			
Elk Creek			116.0			
Nelson	Nebr.		9.4	FD	850	0.10
Mill Creek			30.9			
Washington	Kansas		22.3	FDH	1,500	0.10
Vermillion Creek		116.9				
Onaga	Kansas		25.0	FD	700	0.06
Topeka[4]	Kansas	82.3		FDH	87,000	7.13
Delaware River		63.3				
Grasshopper River			50.3			
Horton, Kansas			5.6	FD	2,700	0.30
Lawrence[4]	Kansas	50.2		FDH	26,900[5]	1.70
Mill Creek		16.0				
Olathe	Kansas		12.0	FD	5,000	0.40
Total					144,210	11.83

---

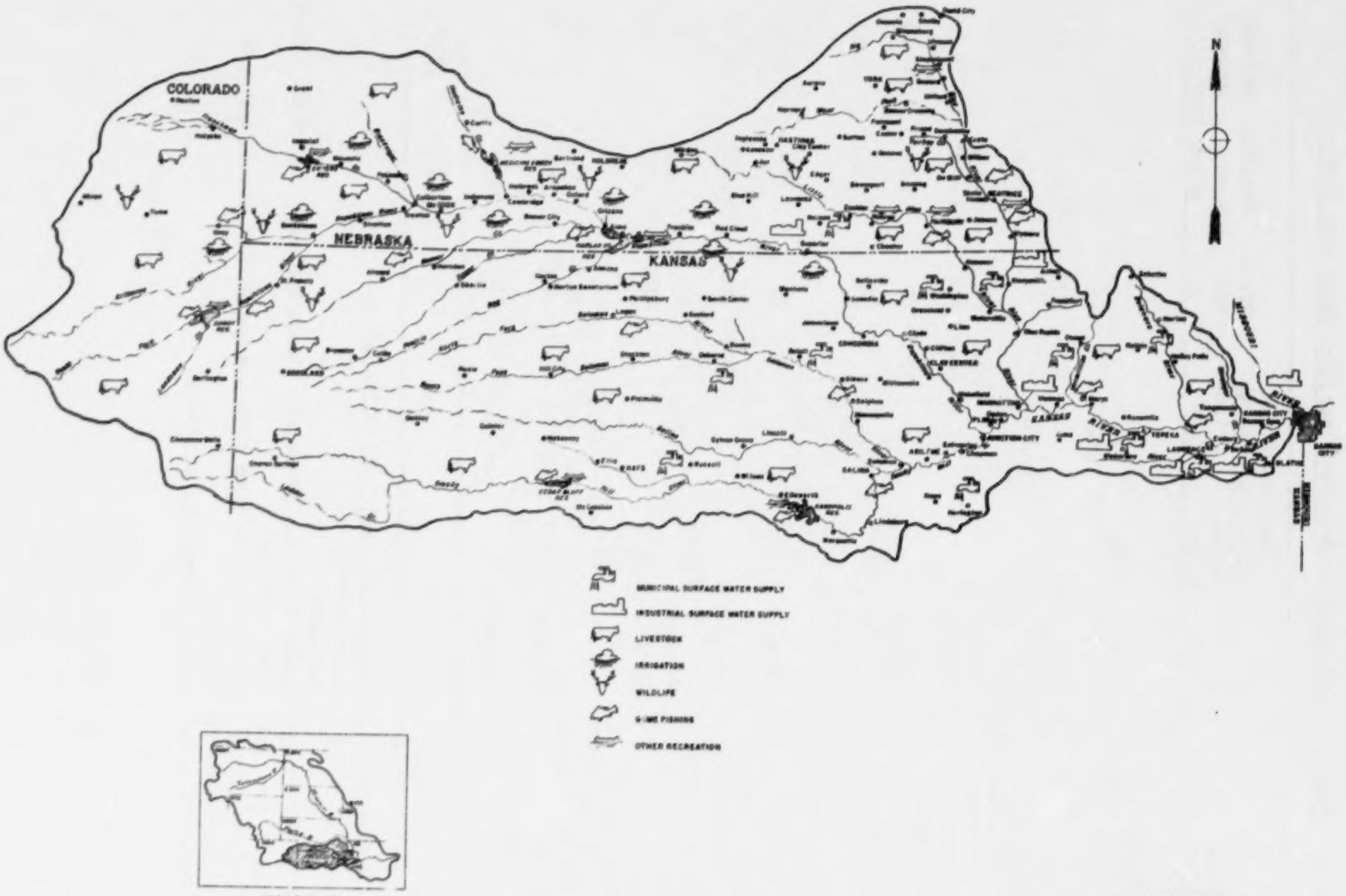
[1] Treatment: F - Coagulated, settled, filtered
D - Chlorinated
H - Softened

[2] Russell obtains water from Big Creek and an impoundment on Fossil Creek.

[3] Also uses water from 5 wells.

[4] Supplementary ground supplies have been developed for occasional use at Lawrence and Topeka.

[5] Includes 8,900 Kansas University students.


COLORADO
NEBRASKA
KANSAS
N
MUNICIPAL SURFACE WATER SUPPLY
INDUSTRIAL SURFACE WATER SUPPLY
LIVESTOCK
IRRIGATION
WILDLIFE
GAME FISHING
OTHER RECREATION
KANSAS RIVER BASIN
LOCATION MAP
MILES

KANSAS RIVER BASIN
EXISTING PRIMARY WATER USES

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO.2

SOURCES OF POLLUTION

Although there are 169 municipal sewer systems discharging wastes into waterways of the Kansas Basin, the relatively small size of, and considerable distance between, sources of pollution have largely limited damages to localized areas. Sources of industrial pollution are primarily concentrated in the lower Kansas River, particularly in the reach from Topeka to the mouth. Extensive sewage treatment is practiced by municipalities located on the smaller streams. Only 28 percent of the municipalities fail to treat their sewage. Untreated wastes from municipalities and industries are organically equivalent to that from 1,806,500 people. Wastes discharged into streams from all sources are equivalent to that from approximately 1,497,000 people. The heavy domestic sewage and industrial waste load from the Kansas City area account for 1,128,400 population equivalents, or 63 percent of the load. Sodium chloride contamination originates in the salt marshes of west central Kansas and from brines from oil wells. A program of injecting brine from producing wells into the oil strata from which it originates is extensively practiced, and brine pollution is gradually being controlled. The naturally high chloride content of the lower reaches of the Saline and Smoky Hill Rivers has made them undesirable sources for municipal water supply.

Significant pollution from industry discharging to city sewers occurs at McCook, Oxford, Holdredge, Red Cloud, Superior, Aurora, Hastings, York, Crete, Beatrice and Fairbury, Nebraska; Concordia, Clay Center, Salina, Abilene, Manhattan, Marysville, Topeka, Lawrence and Kansas City, Kansas; and Kansas City, Missouri.

Wastes from industries having separate sewer outfalls are discharged at numerous locations. The greatest source is the Kansas Citys metropolitan area and includes packing houses, soap manufacturing, and the Kansas City, Missouri, garbage station. Local pollution occurs below industrial sewers at Manhattan, Lawrence, Tonganoxie and Bonner Springs, Kansas.

Tables 5 and 6 list the municipal and separately-sewered industrial sources of pollution together with populations served, degree of treatment provided, and amount of waste discharged in terms of population equivalents. Map No. 3 indicates graphically the location of sources of pollution.

Table 5. Kansas River Basin - Basic data on sources of municipal pollution

Receiving stream and name and location of municipality	River miles from mouth	Sewered population	Estimated untreated waste P.E.	Treatment provided	Adequacy of treatment		Population equivalents discharged (estimated)	Project needs	Community action
					Cap'y.	Oper.			
Kansas River									
Republican River (Tributary 169.2 miles above mouth of Kansas River)									
Landlocked									
Akron, Colo.	-	1,340	1,340	Primary	Sat.	Sat.	Land application	None	-
Yuma, Colo.	-	1,900	1,900	Primary	Sat.	Sat.	None (to lagoons)	None	-
North Fork Republican R.	421.7								
Wray, Colo.	19.5	2,100	3,500	Primary	Uns.	Uns.	2,600	Replace	No action
South Fork Republican R.	393.6								
Benkelman, Nebr.	393.6	1,500	1,500	Primary	Uns.	Uns.	1,500	Replace	No action
St. Francis, Kansas	28.0	1,200	1,200	Secondary	Sat.	Sat.	300	None	-
Stratton, Nebr.	374.9	600	600	Secondary	Sat.	Sat.	240	None	-
Trenton, Nebr.	362.4	850	850	Secondary	Sat.	Sat.	300	None	-
Frenchman Creek	351.6								
Haxtun, Colo.	124.0	1,000	1,000	Primary	Uns.	Uns.	750	New plant	Under construction
Holyoke, Colo.	102.0	1,200	1,200	Secondary	Sat.	Sat.	300	None	-
Landlocked									
Imperial, Nebr.	-	1,250	1,250	Secondary	Sat.	Uns.	620	None	-
Wauneta, Nebr.	42.3	900	900	None	-	-	900	New plant	No action
Palisade, Nebr.	23.6	500	500	Secondary	Sat.	Sat.	160	None	-
Stinking Water Creek	23.5								
Spring Creek	20.1								
Grant, Nebr.	32.0	600	600	Secondary	Sat.	Sat.	300	None	-
Frenchman Creek	351.6								
Culbertson, Nebr.	1.2	600	600	None	-	-	600	New plant	No action
McCook, Nebr.	339.3	7,500	14,300	Secondary	Sat.	Sat.	3,400	None	-
Indianola, Nebr.	325.8	700	700	Secondary	Sat.	Sat.	180	None	-
Medicine Creek	309.6								
Curtis, Nebr.	35.0	900	900	Secondary	Uns.	Sat.	250	Enlarge	No action
Cambridge, Nebr.	0.8	750	750	Secondary	Sat.	Sat.	220	None	-
Holbrook, Nebr.	300.5	400	400	Secondary	Sat.	Sat.	120	None	-
Muddy Creek	292.6								
Arapahoe, Nebr.	0.6	1,200	1,200	None	-	-	1,200	New plant	No action
Oxford, Nebr.	279.8	1,000	2,520	Secondary	Sat.	Sat.	760	None	-
Spring Creek	267.6								
Bertrand, Nebr.	23.0	300	300	Secondary	Sat.	Sat.	80	None	-
Sappa Creek	258.0								
North Fork Sappa Creek	107.8								
Goodland, Kansas	99.0	4,000	4,000	Secondary	Uns.	Sat.	1,100	Enlarge	Under construction
South Fork Sappa Creek	107.8								
Brewster, Kansas	78.0	420	420	Primary	Sat.	Sat.	300	None	-
Oberlin, Kansas	100.8	1,450	1,780	Secondary	Sat.	Sat.	440	None	-
Beaver Creek	12.3								
Burlington, Colo.	236.2	2,200	2,200	Primary	Uns.	Sat.	1,400	Enlarge	No action
Atwood, Kansas	135.7	1,600	1,600	Secondary	Uns.	Uns.	1,000	Replace	No action
Herndon, Kansas	116.5	260	260	Secondary	Sat.	Uns.	60	None	-
Beaver City, Nebr.	18.8	900	900	Primary	Sat.	Sat.	400	None	-
Republican River	169.2								
Orleans, Nebr.	255.0	900	3,600	None	-	-	3,600	New plant	No action
Alma, Nebr.	247.0	1,700	1,700	Secondary	Sat.	Sat.	1,000	None	-
Prairie Dog Creek	239.8								
Colby, Kansas	157.0	3,500	3,500	Secondary	Uns.	Uns.	1,440	Enlarge	Preliminary report
Norton, Kansas	66.0	3,000	3,000	Secondary	Sat.	Uns.	660	None	-
State Sanitarium (Norton)	60.7	500	500	Secondary	Sat.	Sat.	120	None	-
Almena, Kansas	49.6	450	450	Secondary	Uns.	Uns.	400	Replace	No action
Turkey Creek	232.3								
Holdredge, Nebr.	40.0	4,300	7,200	Secondary	Sat.	Uns.	1,870	None	-
Franklin, Nebr.	218.4	1,600	1,600	None	-	-	1,600	New plant	No action
Red Cloud, Nebr.	186.7	1,700	4,850	None	-	-	4,850	New plant	No action
Superior, Nebr.	154.4	3,200	15,200	None	-	-	15,200	New plant	No action
Scandia, Kansas	125.2	500	500	None	-	-	500	New plant	No action
Buffalo Creek	105.2								
Mankato, Kansas	55.2	1,150	1,150	Secondary	Uns.	Sat.	500	Replace	No action
Jamestown, Kansas	15.0	300	300	Secondary	Sat.	Sat.	50	None	-
Concordia, Kansas	102.4	5,800	10,500	None	-	-	10,500	New plant	Preliminary report bonds voted
Salt Creek	90.7								
Belleville, Kansas	20.4	2,200	2,200	Secondary	Uns.	Sat.	1,200	Replace	Preliminary report
Clyde, Kansas	81.8	930	930	Primary	Uns.	Sat.	620	Enlarge	No action
Clifton, Kansas	69.5	300	610	Primary	Uns.	Uns.	540	Enlarge	No action
Tributary									
Linn, Kansas		500	1,000	Secondary	Sat.	Uns.	150	None	-
Clay Center, Kansas	42.1	4,400	6,600	None	-	-	6,600	New plant	Preliminary report
Wakefield, Kansas	25.7	500	500	None	-	-	500	New plant	No action
Junction City, Kansas	4.2	12,000	13,160	None	-	-	13,160	New plant	Bonds voted, new plans being prepared.
Smoky Hill River	169.2								
Cheyenne Wells, Colo.	542.0	1,000	1,000	Primary	Uns.	Sat.	900	Additions	No action
Eagle Tail Creek	501.0								
Sharon Springs, Kansas		710	1,100	Secondary	Uns.	Sat.	480	Replace	Preliminary report
Hackberry Creek	378.2								
Oakley, Kansas	60.0	1,500	1,760	Secondary	Sat.	Sat.	300	None	-
Tributary									
McCracken, Kansas		350	350	Secondary	Sat.	Sat.	50	None	-
Big Creek	292.1								
Quinter, Kansas		400	400	Secondary	Sat.	Sat.	80	None	-
Waukeeney, Kansas	80.0	1,600	1,600	Secondary	Sat.	Sat.	300	None	-
Ellis, Kansas	44.0	1,500	2,000	Secondary	Sat.	Sat.	300	None	-
Hays, Kansas	25.0	6,400	7,810	Secondary	Uns.	Sat.	2,320	Enlarge	Preliminary report bonds voted
Fossil Creek	282.1								
Russell, Kansas	4.5	5,000	5,240	Secondary	Uns.	Sat.	1,520	Enlarge	Preliminary report, bonds voted.
Wilson Creek	252.0								
Wilson, Kansas	2.5	700	2,050	Secondary	Uns.	Sat.	510	Enlarge	No action
Ellsworth, Kansas	238.3	1,650	2,040	Secondary	Sat.	Sat.	510	None	-
Marquette, Kansas	192.5	550	550	None	-	-	550	New plant	No action
Lindsborg, Kansas	167.4	1,700	1,880	Secondary	Sat.	Sat.	520	None	-
Salina, Kansas	123.5	22,000	31,500	Secondary	Sat.	Uns.	13,000	None	-
Saline River	106.5								
Paradise Creek	160.4								
Plainville, Kansas	45.0	1,750	1,880	Secondary	Sat.	Sat.	350	None	-
Tributary									
Lucas, Kansas[1]		-	-	Secondary	Sat.	Sat.	-	None	-
Sylvan Grove, Kansas	116.2	400	560	Secondary	Sat.	Sat.	140	None	-
Lincoln, Kansas	87.4	1,500	1,500	Secondary	Sat.	Sat.	380	None	-
Solomon River	85.4								
South Fork	171.6								
Sand Creek	148.0								
Hoxie, Kansas	8.0	900	1,320	Secondary	Sat.	Sat.	330	Additions	No action
Hill City, Kansas	118.0	950	1,180	Secondary	Sat.	Uns.	300	None	-
Stockton, Kansas	76.0	1,400	1,400	Secondary	Sat.	Sat.	350	None	-
Osborne, Kansas	26.1	1,800	1,800	None	-	-	1,800	New plant	Preliminary report

Table 5. Kansas River Basin - Basic data on sources of municipal pollution (cont'd)

Receiving Stream and name and location of Municipality	River Miles From Mouth	Sewered Population	Estimated Untreated Waste P.E.	Treatment Provided	Adequacy of Treatment Cap'y	Adequacy of Treatment Oper.	Population Equivalents Discharged (Estimated)	Project Needs	Community Action
Kansas River									
Republican River (Tributary 169.2 miles above mouth of Kansas River)									
S. Fork Republican R.	393.6								
St. Francis, Kan.	28.0	1,200	1,200	Secondary	Sat.	Sat.	300	None	--
Sappa Creek	258.0								
N. Fork Sappa Creek	107.8								
Goodland, Kansas	99.0	4,000	4,000	Secondary	Sat.	Sat.	800	None	--
S. Fork Sappa Cr.	107.8								
Brewster, Kansas	78.0	420	420	Primary	Sat.	Sat.	300	None	--
Oberlin, Kansas	100.8	1,450	1,730	Secondary	Sat.	Sat.	440	None	--
Beaver Creek	12.3								
Atwood, Kansas	135.7	1,600	1,600	Secondary	Sat.	Sat.	320	None	--
Herndon, Kansas	116.5	250	260	Secondary	Sat.	Uns.	60	None	--
Republican River	169.2								
Prairie Dog Creek	239.8								
Colby, Kansas	157.0	3,500	3,500	Secondary	Sat.	Sat.	700	None	--
Norton, Kansas	66.0	3,000	3,000	Secondary	Sat.	Uns.	660	None	--
State Sanitarium(Norton)	60.7	500	500	Secondary	Sat.	Sat.	120	None	--
Almena, Kansas	49.6	450	450	Secondary	Sat.	Sat.	90	None	--
Turkey Creek	232.3								
Scandia, Kansas	125.2	500	500	Primary	Sat.	Sat.	325	None	--
Buffalo Creek	105.2								
Mankato, Kansas	55.2	1,150	1,150	Secondary	Sat.	Sat.	230	None	--
Jamestown, Kansas	15.2	300	300	Secondary	Sat.	Sat.	50	None	
Concordia, Kansas	102.4	5,800	10,500	Primary	Sat.	Sat.	6,800	None	--
Salt Creek	90.7								
Belleville, Kansas	20.4	2,200	2,200	Secondary	Sat.	Sat.	440	None	--
Clyde, Kansas	81.8	930	930	Primary	Uns.	Uns.	620	Enlarge	No Action

Table 5. Kansas River Basin - Basic data on sources of municipal pollution (cont'd)

Receiving Stream and name and location of Municipality	River Miles From Mouth	Sewered Population	Estimated Untreated Waste P.E.	Treatment Provided	Adequacy of Treatment		Population Equivalents Discharged (Estimated)	Project Needs	Community Action
					Cap'y	Oper.			
Kansas River									
Republican River	169.2								
Salt Creek	90.7								
Clifton, Kansas	69.5	300	610	Primary	Sat.	Sat.	540	Enlarge	No Action
Tributary									
Linn, Kansas		500	1,000	Secondary	Sat.	Uns.	150	None	--
Clay Center, Kan.	42.1	4,400	6,600	Primary	Sat.	Sat.	4,300	None	--
Wakefield, Kansas	25.7	500	500	Primary	Sat.	Sat.	320	None	--
Junction City, Kan.	4.2	12,000	13,160	Primary	Sat.	Sat.	8,500	None	--
Smoky Hill River	169.2								
Eagle Tail Creek	501.0								
Sharon Springs, Kan.		710	1,100	Secondary	Sat.	Sat.	220	None	--
Big Creek	292.1								
Quinter, Kansas		400	400	Secondary	Sat.	Sat.	80	None	--
Waukeeney, Kansas	80.0	1,600	1,600	Secondary	Sat.	Sat.	300	None	--
Ellis, Kansas	44.0	1,500	2,000	Secondary	Sat.	Sat.	300	None	--
Hays, Kansas	25.0	6,400	7,810	Secondary	Sat.	Sat.	1,350	None	--
Fossil Creek	282.1								
Russell, Kansas	4.5	5,000	5,240	Secondary	Sat.	Sat.	1,050	None	--
Wilson Creek	252.0								
Wilson, Kansas	2.5	700	2,050	Secondary	Sat.	Sat.	400	None	--
Ellsworth, Kansas	238.3	1,650	2,040	Secondary	Sat.	Sat.	510	None	--
Marquette, Kansas	192.5	550	550	Primary	Sat.	Sat.	440	None	--
Lindsborg, Kansas	167.4	1,700	1,880	Secondary	Sat.	Sat.	520	None	--
Salina, Kansas	123.5	22,000	31,500	Secondary	Sat.	Sat.	6,300	None	--
Saline River	106.5								
Paradise Creek	160.4								
Plainville, Kan.	45.0	1,750	1,880	Secondary	Sat.	Sat.	350	None	--

Table 5. Kansas River Basin - Basic data on sources of municipal pollution (cont'd)

Receiving Stream and name and location of Municipality	River miles from mouth	Sewered Population	Estimated Untreated Waste P.E.	Treatment Provided	Adequacy of Treatment Cap'y	Adequacy of Treatment Oper.	Population Equivalents Discharged (Estimated)	Project Needs	Community Action
Kansas River									
Smoky Hill River	169.2								
Saline River	106.5								
Tributary									
Lucas, Kan.[1]		-	-	Secondary	Sat.	Sat.	-	None	--
Sylvan Grove, Kan.	116.2	400	560	Secondary	Sat.	Sat.	140	None	--
Lincoln, Kan.	87.4	1,500	1,500	Secondary	Sat.	Sat.	380	None	--
Solomon River	85.4								
South Fork	171.6								
Sand Creek	148.0								
Hoxie, Kansas	8.0	900	1,320	Secondary	Sat.	Sat.	260	None	--
Hill City, Kan.	118.0	950	1,180	Secondary	Sat.	Sat.	230	None	--
Stockton, Kan.	76.0	1,400	1,400	Secondary	Sat.	Sat.	350	None	--
Osborne, Kan.	26.1	1,800	1,800	Secondary	Sat.	Sat.	360	None	--
North Fork	171.6								
Logan, Kan.	100.0	600	600	Secondary	Sat.	Sat.	150	None	--
Deer Creek	65.3								
Phillipsburg, Kan.	18.0	2,600	2,600	Secondary	Sat.	Sat.	520	None	--
Beaver Creek	45.1								
Smith Center, Kan.	14.4	1,450	1,550	Secondary	Sat.	Sat.	390	None	--
Gaylord, Kan.	42.9	170	170	Secondary	Sat.	Sat.	40	None	--
Downs, Kansas	11.5	1,200	1,330	Secondary	Sat.	Sat.	270	None	--
Beloit, Kansas	130.6	3,800	5,000	Primary	Sat.	Sat.	3,250	None	--
Glasco, Kansas	92.7	650	800	Secondary	Sat.	Sat.	160	None	--
Delphos, Kansas	81.6	500	500	Secondary	Sat.	Sat.	100	None	--
Minneapolis, Kan.	55.8	1,650	2,300	Primary	Sat.	Sat.	1,500	None	--
Solomon, Kansas	85.3	750	750	Primary	Sat.	Sat.	500	None	--
Tributary									
Abilene, Kan.	64.8	5,200	8,300	Primary	Uns.	Sat.	4,200	Enlarge	No Action

Table 5. Kansas River Basin - Basic data on sources of municipal pollution (cont'd)

Receiving Stream and name and location of Municipality	River Miles From Mouth	Sewered Population	Estimated Untreated Waste P.E.	Treatment Provided	Adequacy of Treatment Cap'y	Adequacy of Treatment Oper.	Population Equivalents Discharged (Estimated)	Project Needs	Community Action
Kansas River									
Smoky Hill River	169.2								
Tributary	64.8								
Enterprise, Kan.	55.4	700	700	Primary	Sat.	Sat.	450	None	--
Chapman, Kansas	37.8	700	1,050	Primary	Sat.	Sat.	680	None	--
Chapman Creek	37.8								
Miltonvale, Kan.	46.0	500	500	Secondary	Sat.	Sat.	120	None	--
Lyons Creek	14.0								
Herington, Kan.	37.0	3,150	3,520	Secondary	Sat.	Sat.	260	None	--
West Fork Lyons Cr.	27.0								
Hope, Kansas	10.0	400	400	Secondary	Sat.	Sat.	80	None	--
Fort Riley, Kansas	166.7	13,000	13,000	Secondary	Sat.	Sat.	5,500	None	--
Ogden, Kansas	158.9	450	450	Primary	Sat.	Sat.	290	None	--
Manhattan, Kansas	144.1	20,000	26,200	Primary	Sat.	Sat.	17,000	None	--
Big Blue River	142.5								
North Branch Big Blue	247.3								
North Fork Big Blue	247.3								
West Fork	192.1								
Big Indian Creek	110.4								
Marysville, Kansas	80.0	3,800	5,700	Primary	Sat.	Sat.	4,350	None	--
Mill Creek	30.9								
Washington, Kan.	22.3	1,100	1,360	Secondary	Sat.	Sat.	300	None	--
Hanover, Kansas	26.4	600	1,120	Primary	Sat.	Sat.	730	None	--
Coon Creek	7.5								
Greenleaf, Kan.	24.0	600	600	Secondary	Sat.	Sat.	200	None	--
Waterville, Kan.	6.2	650	1,020	Primary	Sat.	Sat.	660	None	--
Blue Rapids, Kan.	59.5	1,200	2,090	Primary	Sat.	Sat.	1,350	None	--
Black Vermillion River	48.1								
Nameless Creek	24.4								
Axtell, Kansas	16.3	480	480	Secondary	Sat.	Sat.	120	None	--

Table 5. Kansas River Basin - Basic data on sources of municipal pollution (cont'd)

Receiving stream and name and location of Municipality	River Miles From Mouth	Sewered Population	Estimated Untreated Waste P.E.	Treatment Provided	Adequacy of Treatment Cap'y	Adequacy of Treatment Oper.	Population Equivalents Discharged (Estimated)	Project Needs	Community Action
Kansas River									
Big Blue River	142.5								
Black Vermillion Riv.	48.1								
Frankfort, Kan.	12.0	1,100	1,600	Secondary	Sat.	Sat.	320	None	--
Wamego, Kansas	123.6	1,500	1,500	Primary	Sat.	Sat.	[illegible]	None	--
Vermillion River	116.9								
Onaga, Kansas	25.0	780	780	Secondary	Sat.	Sat.	160	None	--
St. Marys, Kansas	107.7	800	1,180	Primary	Sat.	Sat.	770	None	--
St. Marys College St. Marys, Kansas	107.7	220	220	Septic tanks	Uns.	Sat.	220	Replace	No Action
Mill Creek	101.5								
Alma, Kansas	18.0	740	[illegible]	Secondary	Sat.	Sat.	200	None	--
Cross Creek	100.1								
Rossville, Kansas	3.0	500	500	Secondary	Sat.	Uns.	120	None	--
Kansas State Hospital		2,100	2,100	Secondary	Sat.	Sat.	300	None	--
Topeka, Kan. (Plt. #1)	82.3	78,000	120,000	Secondary	Uns.	Sat.	30,000	None	--
Topeka, Kan. (Plt. #2)	82.3	5,800	5,800	Primary	Uns.	Sat.	4,350	Connect to Plt. #1	Plans Initiated
Topeka, Kan. (West end)	82.3	13,200	13,200	None	-	-	13,200	Connect to Plt. #1	Under Construction
Shunganunga Creek	73.9								
Forbes Air Base		8,000	8,000	Secondary	Sat.	Sat.	4,000	Additions	---
Soldier Creek	80.2								
Boys Ind. School Topeka, Kansas	3.5	200	200	Secondary	Sat.	Sat.	40	None	---
Delaware River	63.3								
Webster Creek	85								
Sabetha, Kan. (S. Plt)	15	1,000	5,500	Secondary	Sat.	Sat.	750	None	----

Table 5. Kansas River Basin - Basic data on [illegible]urces of municipal pollution (cont'd)

Receiving stream and name and location of Municipality	River Miles From Mouth	Sewered Population	Estimated Untreated Waste P.E.	Treatment Provided	Adequacy of Treatment Cap'y	Oper.	Population Equivalents Discharged (Estimated)	Project Needs	Community Action
Kansas River									
Delaware River	63.3								
Grasshopper River	50.3								
Horton, Kansas	5.6	2,400	3,360	Secondary	Sat.	Sat.	670	None	---
Elk Creek	42.6								
Holton, Kansas	11.6	2,500	4,010	Secondary	Sat.	Sat.	800	None	---
Delaware River	63.3								
Valley Falls, Kan.	29.7	1,000	1,940	Secondary	Sat.	Uns.	390	None	---
Lawrence, Kansas	50.2	23,000	31,000	Primary	Sat.	Sat.	20,000	None	---
Eudora, Kansas	45.9	900	1,440	Primary	Sat.	Sat.	940	None	---
Wakarusa River	40.7								
Haskell Institute, Lawrence, Kan.		500	500	Secondary	Sat.	Sat.	80	None	---
Stranger Creek	33.6								
Tonganoxie, Creek	16.0								
Tonganoxie, Kansas	3.1	1,000	1,000	Secondary	Sat.	Sat.	200	None	---
DeSoto, Kansas	30.0	500	500	Primary	Sat.	Sat.	325	None	---
Kill Creek	29.5								
Sunflower, Kansas	2.0	5,000	5,000	Secondary	Sat.	Sat.	1,250	None	---
Sunflower Ordnance Staff Village	2.0	200	200	Secondary	Sat.	Uns.	80	None	---
Sunflower Ordnance		7,000	7,000	Secondary	Sat.	Sat.	1,750	None	---
Bonner Springs, Kansas	20.2	1,850	1,850	Primary	Sat.	Sat.	1,200	None	---
Mill Creek	16.0								
Olathe, Kansas	12.0	5,500	5,500	Secondary	Sat.	Sat.	1,100	None	---
Turkey Creek	3.2								
Mission Township	3.0	60,000	60,000	Secondary	Uns.	Sat.	12,000	Enlarge	Under Const.
Kansas City, Kansas[2]	3.0	38,000	153,100	None	-	-	153,100	New Plant	Preliminary report in preparation

Table 5. Kansas River Basin - Basic data on sources of municipal pollution (cont'd)

1 - New treatment plant completed September 1952. House connections to sewers now underway.

2 - 71,000 population equivalents, in addition, to the Missouri River.

4 - Military Base - population fluctuates. Also, oil problems due to plane washing facilities.

Table 5. Kansas River Basin - Basic data on sources of municipal pollution (cont'd.)

Receiving stream and name and location of municipality	River miles from mouth	Sewered population	Estimated untreated waste P.E.	Treatment provided	Adequacy of treatment Cap'y.	Adequacy of treatment Oper.	Population equivalents discharged (estimated)	Project needs	Community action
Kansas River									
Smoky Hill River	169.2								
Solomon River	85.4								
North Fork	171.6								
Logan, Kansas	100.0	600	600	Secondary	Sat.	Sat.	150	None	-
Deer Creek	65.3								
Phillipsburg, Kansas	18.0	2,600	2,600	Secondary	Sat.	Uns.	800	None	-
Beaver Creek	45.1								
Smith Center, Kansas	14.4	1,450	1,550	Secondary	Sat.	Sat.	390	None	-
Gaylord, Kansas	42.9	170	170	Secondary	Sat.	Sat.	40	None	-
Downs, Kansas	11.5	1,200	1,330	None	-	-	1,330	New plant	No action
Beloit, Kansas	130.6	3,800	5,000	None	-	-	5,000	New plant	Preliminary report
Glasco, Kansas	92.7	650	800	None	-	-	800	New plant	No action
Delphos, Kansas	81.6	500	500	Secondary	Sat.	Sat.	100	None	-
Minneapolis, Kansas	55.8	1,650	2,300	None	-	-	2,300	New plant	No action
Solomon, Kansas	85.3	750	750	None	-	-	750	New plant	No action
Tributary									
Abilene, Kansas	64.8	5,200	8,300	Primary	Uns.	Sat.	4,200	Enlarge	No action
Enterprise, Kansas	55.4	700	700	None	-	-	700	New plant	Plans approved
Chapman, Kansas	37.8	700	970	None	-	-	970	New plant	Preliminary report
Chapman Creek	37.6								
Miltonvale, Kansas	46.0	500	500	Secondary	Sat.	Sat.	120	None	-
Lyons Creek	14.0								
Herington, Kansas	37.0	3,150	3,520	Secondary	Sat.	Sat.	260	None	-
West Fork Lyons Creek	27.0								
Hope, Kansas	10.0	400	400	Secondary	Sat.	Uns.	80	None	-
Fort Riley, Kansas	166.7	13,000	13,000	Secondary	Sat.	Sat.	5,500	None	-
Ogden, Kansas	158.9	450	450	None	-	-	~~450~~ 290	New plant	No action
Manhattan, Kansas	144.1	20,000	26,200	None	-	-	~~26,200~~ 17000	New plant	No action
Big Blue River	142.5								
North Branch Big Blue	247.3								
Stromsburg, Nebr.	29.5	1,100	1,100	None	-	-	1,100	New plant	No action
Davis Creek	22.4								
Osceola, Nebr.	5.0	950	950	Secondary	Sat.	Uns.	380	None	-
Shelby, Nebr.	18.0	350	350	Secondary	Sat.	Sat.	180	None	-
North Fork Big Blue	247.3								
Keyser Creek	16.6								
David City, Nebr.	6.8	2,400	2,500	Secondary	Sat.	Uns.	500	None	-
Ulysses, Nebr.	-	300	300	None	-	-	300	New plant	No action
Staplehurst, Nebr.	236.0	200	200	Primary	Sat.	Sat.	130	None	-
Lincoln Creek	255.5								
Aurora, Nebr.	73.0	2,000	5,400	Secondary	Uns.	Sat.	1,600	Enlarge	No action
Seward, Nebr.	225.3	3,100	4,100	None	-	-	4,100	New plant	No action
Milford, Nebr.	204.0	900	900	None	-	-	900	New plant	No action
West Fork	192.1								
South Branch	34.1								
Hastings, Nebr.	76.7	20,000	25,700	Secondary	Uns.	Sat.	6,500	Enlarge	Under construction
School Creek	33.0								
Harvard, Nebr.	26.0	600	600	Secondary	Sat.	Uns.	120	None	-
Sutton, Nebr.	7.0	1,300	1,300	Secondary	Sat.	Sat.	200	None	-
Beaver Creek	34.1								
York, Nebr.	19.5	6,000	9,900	Secondary	Sat.	Uns.	4,850	None	-
Indian Creek	29.6								
Fairmount, Nebr.	28.0	750	750	Secondary	Sat.	Sat.	110	None	-
Beaver Crossing, Nebr.	29.0	300	300	Secondary	Uns.	Uns.	200	Replace	No action
Johnson Creek	11.7								
Exeter, Nebr.	25.0	550	550	Secondary	Sat.	Uns.	140	None	-
Crete, Nebr.	180.8	3,500	8,500	Secondary	Uns.	Sat.	2,550	Enlarge	No action
Squaw Creek	176.8								
Dorchester, Nebr.	11.6	580	580	Secondary	Sat.	Sat.	170	None	-
Wilber, Nebr.	167.1	1,300	1,300	None	-	-	1,300	New plant	No action
Turkey Creek	150.8								
Geneva, Nebr.	53.0	1,000	1,000	Secondary	Sat.	Sat.	300	None	-
Friend, Nebr.	45.0	1,000	1,000	Secondary	Sat.	Uns.	200	None	-
DeWitt, Nebr.	4.2	400	400	Secondary	Sat.	Sat.	100	None	-
State Home (Beatrice,Nebr.)	130.0	2,000	2,000	Secondary	Sat.	Sat.	300	None	-
Beatrice, Nebr.	130.0	11,000	16,000	None	-	-	16,000	New plant	No action
Wymore, Nebr.	110.7	2,700	2,700	Secondary	Sat.	Sat.	800	None	-
Big Indian Creek	110.4								
Jansen, Nebr.	35.0	160	160	Secondary	Sat.	Uns.	30	None	-
Marysville, Kansas	80.0	3,800	6,700	None	-	-	6,700	New plant	No action
Little Blue River	61.8								
Minden, Nebr.	195.0	1,200	1,200	Secondary	Sat.	Sat.	360	None	-
Blue Hill, Nebr.	169.0	400	400	Secondary	Sat.	Sat.	100	None	-
Thirty-two Mile Creek	152.0								
Kenesaw, Nebr.	25.0	220	220	Secondary	Sat.	Uns.	50	None	-
Pawnee Creek	138.9								
Ingleside, Nebr.	27.0	2,000	2,000	Secondary	Sat.	Uns.	500	None	-
Dry Creek	13[illegible].4								
Lawrence, Nebr.	7.0	220	220	Secondary	Sat.	Sat.	20	None	-
Elk Creek	116.0								
Nelson, Nebr.	9.4	750	750	None	-	-	750	New plant	No action
Hebron, Nebr.	89.6	2,000	2,800	None	-	-	2,800	New plant	No action
Spring Creek	88.8								
Deshler, Nebr.	9.6	1,200	1,200	Secondary	Sat.	Sat.	360	None	-
Sandy Creek	68.1								
Edgar, Nebr.	49.0	800	800	Secondary	Sat.	Sat.	200	None	-
Davenport, Nebr.	40.0	250	250	Secondary	Sat.	Uns.	80	None	-
Little Sandy Creek	39.0								
Clay Center, Nebr.	30.0	800	800	Secondary	Sat.	Uns.	240	None	-
Dry Sandy Creek	11.0								
Bruning, Nebr.	14.0	120	120	Secondary	Sat.	Sat.	20	None	-
Fairbury, Nebr.	55.4	6,300	14,800	None	-	-	14,800	New plant	No action
Rose Creek	50.0								
Chester, Nebr.	32.0	250	250	Secondary	Sat.	Sat.	60	None	-
Mill Creek	30.9								
Washington, Kansas	22.3	1,100	1,360	Secondary	Sat.	Sat.	300	None	-
Hanover, Kansas	26.4	600	1,120	None	-	-	1,120	New plant	No action
Coon Creek	7.5								
Greenleaf, Kansas	24.0	600	600	Secondary	Sat.	Sat.	100	None	-
Waterville, Kansas	6.2	650	1,020	None	-	-	1,020	New plant	No action
Blue Rapids, Kansas	59.5	1,200	2,090	None	-	-	2,090	New plant	Plans initiated
Black Vermillion River	48.1								
Nameless Creek	24.4								
Axtell, Kansas	16.3	480	480	Secondary	Sat.	Sat.	120	None	-

Table 5. Kansas River Basin - Basic data on sources of municipal pollution (cont'd.)

Receiving stream and name and location of municipality	River miles from mouth	Sewered population	Estimated untreated waste P.E.	Treatment provided	Adequacy of treatment		Population equivalents discharged (estimated)	Project needs	Community action
					Cap'y.	Oper.			
Kansas River									
Big Blue River	142.5								
Black Vermillion River	48.1								
Frankfort, Kansas	12.0	1,100	1,600	None	-	-	1,600	New plant	Plans initiated
Wamego, Kansas	123.6	1,500	1,500	None	-	-	1,500 970	New plant	No action
Vermillion River	116.9								
Onaga, Kansas	25.0	780	780	Secondary	Uns.	Uns.	500 160	Replace	No action
St. Marys, Kansas	107.7	800	1,180	Primary	Uns.	Uns.	1,000 770	Replace	Preliminary report
St. Marys College St. Marys, Kansas	107.7	220	220	Septic tanks	Uns.	Sat.	200 220	Replace	No action
Mill Creek	101.5								
Alma, Kansas	18.0	740	1,000	Secondary	Sat.	Sat.	250	Additions	Under construction
Cross Creek	100.1								
Rossville, Kansas	3.0	500	500	Secondary	Sat.	Sat.	120	None	-
Kansas State Hospital		2,100	2,100	Secondary	Sat.	Sat.	300	None	-
Topeka, Kansas (Plant #1)	82.3	78,000	120,000	Secondary	Uns.	Sat.	30,000	Enlarge	Under construction
Topeka, Kansas (Plant #2)	82.3	5,800	5,800	Primary	Uns.	Sat.	4,350	Connect to Plant #1	-
Topeka, Kansas (West End)	82.3	13,200	13,200	None	-	-	13,200	Connect to Plant #1	-
Shunganunga Creek	73.9								
Forbes Air Base		8,000	8,000	Secondary	Uns.	Uns.	4,000	Additions	Under construction
Soldier Creek	80.2								
Kansas Technical Institute Topeka, Kansas	3.5	200	200	Secondary	Sat.	Sat.	40	None	-
Delaware River	63.3								
Webster Creek	85								
Sabetha, Kansas (S.Plant)	15	1,000	5,500	Secondary	Sat.	Sat.	750	None	-
Grasshopper River	50.3								
Horton, Kansas	5.6	2,400	3,360	Secondary	Uns.	Sat.	750	Replace	Preliminary report
Elk Creek	42.6								
Holton, Kansas	11.6	2,500	4,010	Secondary	Sat.	Uns.	1,000	None	-
Delaware River	63.3								
Valley Falls, Kansas	29.7	1,000	1,940	None	-	-	1,940	New plant	No action
Lawrence, Kansas	50.2	23,000	31,000	None	-	-	~~31,000~~ 23,000	New plant	Preliminary report
Eudora, Kansas	45.9	900	1,440	None	-	-	~~1,440~~ 940	New plant	Plans initiated
Wakarusa River	40.7								
Haskell Institute Lawrence, Kansas		500	500	Secondary	Sat.	Sat.	80	None	-
Stranger Creek	33.6								
Tonganoxie Creek	16.0								
Tonganoxie, Kansas	3.1	1,000	1,000	Secondary	Uns.	Sat.	~~500~~ 200	Replace	No action
DeSoto, Kansas	30.0	500	500	None	-	-	500	New plant	No action
Kill Creek	29.5								
Sunflower, Kansas	2.0	5,000	5,000	Secondary	Sat.	Sat.	1,250	None	-
Sunflower Ordnance Staff Village	2.0	200	200	Secondary	Sat.	Uns.	80	None	-
Sunflower Ordnance		7,000	7,000	Secondary	Sat.	Sat.	1,750	None	-
Bonner Springs, Kansas	20.2	1,850	1,850	None Pri	-	-	~~1,850~~ 1,200	New plant	No action
Mill Creek	16.0								
Olathe, Kansas	12.0	5,500	5,500	Secondary	Uns.	Sat.	2,750	Replace	Part of improvements under construction
Grade and High Schools Turner, Kansas	9.6	1,110	1,110	None	-	-	1,110	New plant	No action
Turkey Creek	3.2								
Mission Township	3.0	~~32,000~~ 60,000	~~32,000~~ 60,000	Secondary	Uns.	Sat.	~~5,000~~ 12,000	Enlarge	Under construction
Kansas City, Kansas[2]	3.0	38,000	153,100	None	-	-	153,100	New plant	Preliminary report in preparation
Kansas City, Mo.[3]	3.0	99,000	281,200	None	-	-	281,200	New plant	No action
Totals		624,560	1,086,750				777,630		

[1] New treatment plant completed September, 1952. House connections to sewers now under way.

[2] 71,000 population equivalents discharge, in addition, to the Missouri River.

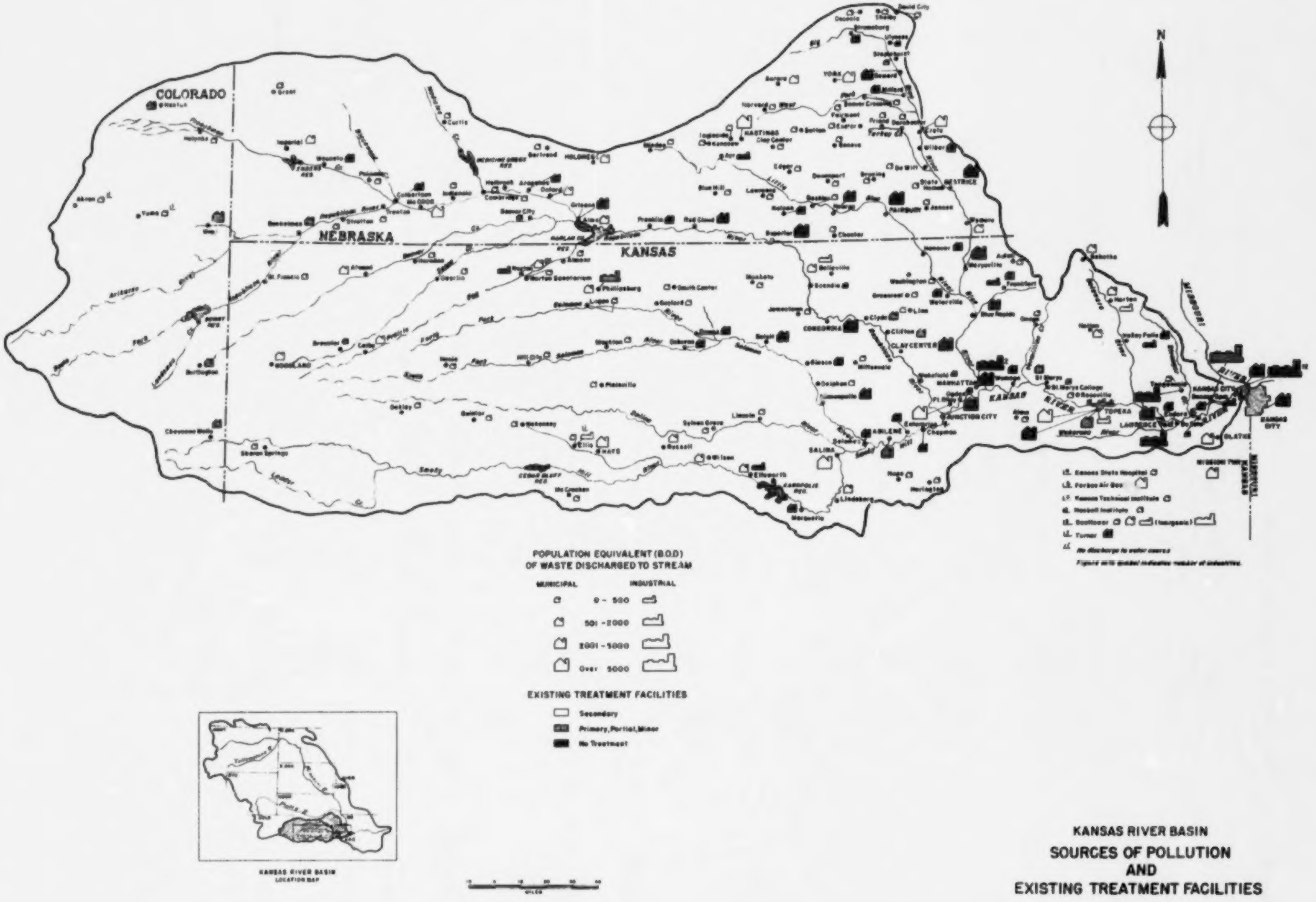
[3] 106,900 population equivalents discharged, in addition, to the Missouri River, and 342,000 population equivalents discharge, in addition, to the Blue River.

Table 6. Kansas River Basin - Basic data on sources of industrial pollution[1]

Name and location	Type of industry	Type of waste produced	Treatment or other pollution control measures		Population equivalent discharged to watercourse	Pollution abatement measures needed	Project Status
			Degree	Adequacy			
Kansas River Republican River Prairie Dog Creek							
Norton Ice & Meat Co. Norton, Kansas	Food products	Organic	Partial	Inadequate	100	New plant or other control measures	No action
Salt Creek							
Rendering Plant Belleville, Kansas	Food products	Organic	Secondary	Adequate	50	None	
Smoky Hill River							
Rendering Plant, Ellis, Kansas	Food products	Organic	Major	Adequate	None	None	
Slaughterhouse Ellsworth, Kansas	Food products	Organic	None	Inadequate	230	New plant or other control measures	No action
Solomon River North Fork Deer Creek							
Co-Op Oil Refinery Phillipsburg, Kansas	Petroleum products	Organic and Inorganic	Partial	Adequate[2]	1,500	None	
Patterson-Harwood Laboratory Manhattan, Kansas	Chemical products	Organic	None	Inadequate	2,670)	New plants or connect to Manhattan sewers	No action
Dearborn Packing Plant Manhattan, Kansas	Food products	Organic	None	Inadequate	240)		No action
Blue River Little Blue River							
Slaughterhouse, Ayr, Nebraska	Food products	Organic	None	Inadequate	350	New plant or other control measures	No action
Black Vermillion River							
Rendering Plant Frankfort, Kansas	Food products	Organic	None	Inadequate	180	New plant or other control measures	No action
Soldier Creek							
Goodyear Tire Company Topeka, Kansas	Rubber products	Organic	Secondary[3]	Adequate	50	None	
Delaware River Grasshopper Creek							
Rendering Plant Horton, Kansas	Food products	Organic	Major	Adequate	-	None	
Mitchell Sausage Factory Valley Falls, Kansas	Food products	Organic	None	Inadequate	190	New plant or other control measures	No action
Lawrence Paper Company Lawrence, Kansas	Paper products	Organic	None	Inadequate	4,400	New plant or other control measures	No action
Stranger Creek Tonganoxie Creek							
Franklin Ice Cream Co. Tonganoxie, Kansas	Food products	Organic	Partial[4]	Inadequate	3,100	New plant or othe. control measures	No action
Kill Creek							
Sunflower Ordnance Sunflower, Kansas	Chemical	Inorganic	Major	Inadequate	None	New plant[5]	
Wolf Creek							
R. B. Rice Sausage Co. Bonner Springs, Kansas	Food products	Organic	None	Inadequate	290	New plant or other control measures	No action
Kuhn Cannery Bonner Springs, Kansas	Food products	Organic	Minor	Inadequate	13,400	New plant or other control measures	No action
Kansas River							
Kansas City, Kansas[6]	Food, chemical, petroleum and miscellaneous products and services	Organic and Inorganic	None	Inadequate	693,000	New plant	Preliminary report
Total					719,750		

---

[1] Includes only those industries having separate waste outlets.
[2] Improved operation of existing oil separation equipment needed.
[3] Sanitary wastes only - Industrial wastes, consisting of rubber particles, not treated.
[4] Experimental plant provides unsatisfactory degree of treatment.
[5] Neutralization of acid wastes required.
[6] Includes 12 industries known to have separate outlets.


N
COLORADO
NEBRASKA
KANSAS
MISSOURI
KANSAS RIVER
MISSOURI RIVER
KANSAS CITY
TOPEKA
LAWRENCE
OLATHE
MANHATTAN
JUNCTION CITY
ABILENE
SALINA
CONCORDIA
CLAY CENTER
HASTINGS
YORK
BEATRICE
HAYS
HOLDREGE
McCOOK
POPULATION EQUIVALENT (B.O.D)
OF WASTE DISCHARGED TO STREAM
MUNICIPAL
INDUSTRIAL
0 - 500
501 - 2000
2001 - 5000
Over 5000
EXISTING TREATMENT FACILITIES
Secondary
Primary, Partial, Minor
No Treatment
Kansas State Hospital
Forbes Air Base
Kansas Technical Institute
Haskell Institute
Sunflower (Inorganic)
Turner
No discharge to water course
Figure with symbol indicates number of industries.
KANSAS RIVER BASIN
LOCATION MAP
MILES

KANSAS RIVER BASIN
SOURCES OF POLLUTION
AND
EXISTING TREATMENT FACILITIES

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO. 3

DAMAGES TO WATER RESOURCES FROM POLLUTION

Pollution from both mineral and organic material has affected water resources of the Kansas Basin at a number of places. Although damages have been rectified through control or abatement of pollution at some points, they continue to persist at other places.

The damaging effect of pollution on domestic and industrial water supplies is of paramount importance. During periods of low flows control of tastes and odors becomes difficult and large numbers of bacteria in the raw water reduce the safety factor in the treatment processes. Surface water supplies at Marysville, Topeka, and Lawrence, Kansas, have been subjected to damaging effects from organic pollution. In 1922 the Kansas State Board of Health conducted a study to evaluate the bacterial effect of pollution on streams of the Kansas River system, particularly as the contamination influenced municipal surface water supplies. Selected data from this early study and results of the 1948 investigation of stream pollution in the Kansas Basin at comparable sampling stations are shown in table 7. The 1948 data have been recalculated as indicated numbers per 100 ml. to correspond with the earlier study. In all instances the coliform numbers have drastically increased at water works intakes or below sources of pollution. The increase in coliform densities at the water intakes at Marysville, Topeka, and Lawrence (table 7) represents a direct damage from pollution. The bacterial quality of stream water shows a general deterioration, which manifestly can be reversed by adequate sewage treatment. The early study led to sewage treatment at Topeka.

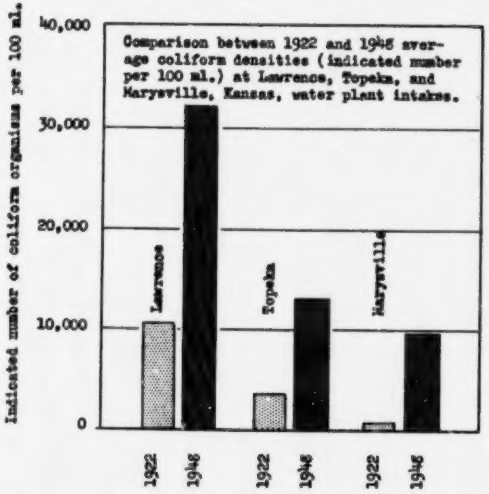
Mineral pollution originating from salt waters has affected water supplies at Topeka and Lawrence and has caused considerable damage to ground water supplies and surface streams of west central Kansas. Brine contamination destroyed usefulness of streams and ground water sources for stock watering or domestic water supplies, killed fish, and destroyed vegetation along the stream banks. While salt in the Saline River originates largely from natural salt springs, some of the present chloride content of the Saline and Smoky Hill Rivers stems from oil well brines which have not yet been placed under control.

Many sewage treatment facilities were constructed following complaints of nuisance conditions originating from decomposing sewage below sewer outlets. These conditions occurred frequently where only small amounts of water were available for dilution of wastes from rapidly growing cities and industries. Fortunately sewage treatment is usually instituted before conditions become serious enough to warrant court action. At the present time nuisance conditions do exist at many locations, as for example, below Superior, Nebraska, on the Republican River; Fairbury, Nebraska, on the Little Blue; Beatrice, Nebraska, and Marysville, Kansas, on the Big Blue; York, Nebraska, on Beaver Creek; the Forbes Air Base in Kansas on Shunganunga Creek; the Franklin Ice Cream Company at Tonganoxie, Kansas, on Tonganoxie Creek; the rendering plant at Horton, Kansas, on Grasshopper Creek; and in the Kansas River in the Kansas City metropolitan area. Damaging effects from pollution have also been observed at Frankfort, Kansas, and Hastings, Nebraska. Fish have been killed from extensive pollution emanating from the municipal sewer system of York, Nebraska.

Table 7. Kansas River Basin - Comparison of 1922 and 1948 coliform data

Location (River miles)	Coliform organisms - Indicated numbers per 100 ml.							
	1922[a]				1948[b]			
	Average	Maximum	Minimum	Median	Average	Maximum	Minimum	Median
Kansas River								
Lawrence, Kans. (K-50.6) Water Plant Intake	10,200	40,000	40	7,000	31,900	100,000	1,000	10,000
Below Topeka (K-78.7)	22,300	280,000	400	7,300	44,700	100,000	7,000	40,000
Above Topeka, Kans. (K-85.5) Near water supply intake	3,300	28,000	2.5	910	12,900	70,000	400	7,000
Southwest of Manhattan, Kans. (K-159.4)	5,350	37,000	73	2,400	74,000	400,000	4,000	40,000
Blue River								
Marysville, Kans. (B-80.0)	400	1,900	4.6	82	9,900	40,000	400	4,000
Republican River								
Below Clay Center, Kans. (R-35.9)	4,550	19,000	37	1,900	42,800	400,000	7,000	10,000
Above Concordia, Kans. (R-102.4)	2,540	19,000	4	550	6,950	40,000	400	7,000
Smoky Hill River								
Junction City, Kans. (SH-4.5)	3,970	45,000	70	910	14,800	70,000	1,000	7,000

[a] The Kansas River and its Tributaries - Division of Water and Sewage, Kansas State Board of Health (1923).
[b] Kansas River Basin Water Pollution Investigation (June 1949).


Comparison between 1922 and 1948 average coliform densities (indicated number per 100 ml.) at Lawrence, Topeka, and Marysville, Kansas, water plant intakes.

Interstate pollution occurs at several points in the Basin, principally below Superior, Nebraska, on the Republican River; on the Little Blue River below Fairbury, Nebraska; and, below Beatrice, Nebraska, on the Big Blue River.

The oil industry has experienced numerous lawsuits because of inadequate control of brines. Oil emanating from the refinery at Phillipsburg, Kansas, has seriously impaired the uses of a small stream receiving refinery wastes and has polluted the ground water. At times this pollution is reported to be sufficiently extensive to affect the Solomon River into which the tributary drains. Pollution from the Kansas City, Missouri, and Kansas City, Kansas, area causes unsightly conditions and foul odors in the lower three miles of the river. Great quantities of untreated organic materials from packing houses, stockyards, soap factories, garbage disposal plant and other sources are emptied into this river reach.

Some sewage treatment plants discharge digesting sludges into the streams during high water. This practice may be responsible for sudden increases of coliform organisms at the intakes of water treatment plants at Topeka and Lawrence, Kansas.

Organic pollution has caused local nuisances, produced damaging effects on recreation and fish life, increased the cost of municipal and industrial water treatment, effected a reduction in the safety factors guarding the domestic water supplies, caused impairment of streams for stock watering, and has been a factor in property devaluation. Brine pollution has damaged fishing, livestock watering, domestic water supplies - particularly farm wells - devaluated property, and caused concern regarding the use of surface water supplies where chlorides have reached alarming proportions.

BENEFITS RESULTING FROM POLLUTION PREVENTION AND ABATEMENT

The principal benefits to be derived from adequate control of sewage and industrial wastes is conservation of water resources for more and higher uses, and conservation of waste materials for beneficial purposes. With respect to the conservation of waste materials, reclamation of humus and fertilizer in domestic and industrial wastes can be in many cases an important factor in the over-all conservation effort. Brine from oil wells, when reinjected into oil-bearing stratas, has been found to increase the productivity of wells, thus becoming a valuable asset instead of a liability to the oil industry.

The removal of excessive organic and mineral matter from waterways of the Basin will be of particular benefit to irrigation. The use of sewage contaminated water for irrigation constitutes a health hazard both to workers in the field and to consumers of uncooked truck crops.

The quality of the Lawrence raw water supply has been improved by sewage and industrial waste treatment at Topeka. Benefits will be realized by water supplies taken from the Kansas and Blue Rivers as upstream municipal and industrial waste treatment is provided. Large industries which obtain their water supply from streams would benefit from reduced mineral content in the water supply and from reduced organic and bacterial pollution. The efficiency of industrial cooling water systems would be increased from reduced mineral and organic matter. Improved water quality would reduce the cost of treatment and maintenance. Complete control of oil field brines would be of particular benefit to farmers and ranchers in the immediate neighborhood of the brine discharges. Protection given ground water supplies is very important as wells spoiled by salt water intrusion may not be reclaimed for many years.

Basin streams have value for local recreational pursuits. Alleviation of pollution would safeguard these interests. Construction of large reservoirs in the Basin provides much needed water related recreational areas. Adequate protection of these bodies of water from pollution is imperative. Fishing will also benefit from regulation of stream flows. It will be necessary, however, to prevent oxygen depletion in certain reaches of these streams if valuable fishing is to be sustained.

One of the most important but less tangible aspects of pollution control is the aesthetic value of a clean stream. It may be difficult to assess a monetary value on the aesthetic; however, this in no way diminishes from its importance. It is axiomatic that when a man's surroundings are pleasant and healthful he tends towards a longer and more productive life. Clean streams contribute much to the improvement of man's environment.

POLLUTION PREVENTION MEASURES IN EFFECT

Control of pollution in the Basin has progressed under the guidance of the Colorado Department of Public Health, the Kansas State Board of Health, and the Nebraska Department of Health. It has been supported by a citizenry who have not been content to see valuable water resources lost to the effects of pollution. While the job has not yet been completed, that portion of the program now in effect is emphasized by 131 existing municipal and industrial waste treatment works. The total organic load tributary to the Kansas River system is reduced approximately 17 percent by treatment. The reduction is much greater if Kansas City, Kansas, and Kansas City, Missouri, are not included. Approximately 72 percent of the municipalities provide treatment.

The legislature of the State of Kansas early recognized the problems which were incurred by indiscriminate disposal of salt water from oil wells and instituted the first statutory control of the disposal of such wastes in the United States. Responsibility for carrying out the provisions of the law is centered in the State Board of Health which has been most diligent in its efforts to control brine contamination of both surface and ground waters. It is reported that the oil industry has spent 50 million dollars in the State of Kansas in recent years in providing proper methods of disposal of salt water. The method found to be most satisfactory is that of recharging the oil-bearing formations with the brine by gravity or injection wells.

The construction of municipal sewage treatment plants has progressed rapidly in the years following World War II. Since 1946, 22 new plants, 8 plant replacements, and 6 plant enlargements or additions have been provided (table 8). Adequate treatment has thus been provided to approximately 109,200 people in the past 6 years. Of these improvements 19 were made in Kansas, 15 in Nebraska, and 2 in Colorado.

A large measure of the present control can be attributed to the educational programs instituted by State health agencies who have made a special effort to discuss pollution control with local groups. Operators of sewage treatment works have been kept informed concerning new methods of treatment and improvements in older methods. The number of plants and the degree of treatment provided is shown in table 9. In Kansas it has been a practice to maintain three-day training schools for sewage plant operators. The State pollution control agencies periodically inspect treatment works and submit reports to municipal officials. Kansas, using a mobile laboratory, recently inaugurated a program to supplement plant inspections with laboratory investigations of waste discharges and stream conditions.

The State agencies exercise control over construction of treatment works by requiring the submission, for review and approval, of plans and specifications for treatment plants. This action has resulted in the construction of works adequate to meet foreseeable needs. Kansas requires a permit prior to the discharge of any industrial or domestic wastes. The permit system has kept the State agency informed of new pollution sources and types of wastes thereby enabling the agency to require adequate wastes treatment prior to discharge into watercourses.

Table 8. Kansas River Basin - Progress in pollution abatement

Year	Municipal		Industrial
	Plants completed	Design population	Plants completed
1946	1	2,200	0
1947	5*	8,167	0
1948	5*	2,750	0
1949	9*	27,186	0
1950	8*	30,230	0
1951	5*	7,150	0
1952	3*	1,700	0

*Includes improvements to existing plants.

Table 9. Kansas River Basin - Summary of existing treatment

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	15	15	25,590
Secondary	106**a	106	319,040
No treatment	47***	-	279,710

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers; sanitary sewage wastes discharged by industry directly to watercourse and industrial wastes discharged into municipal sewage systems.

**Includes one municipality for which population served data are not available.

[a] Topeka has a primary treatment plant which serves 5,800 people. In addition Topeka discharges wastes from a population of 13,200 without treatment.

***Does not include one septic tank installation which treats wastes from 220 people.

Kansas statutes have proven to be workable laws under which the responsible agency has been able to carry out a comprehensive program of domestic and industrial waste control. Municipal finance laws of Kansas are generally adequate to enable the construction of municipal waste treatment facilities, but do not, in all cases, permit revenue bond financing for operation and maintenance.

Water pollution control laws of Colorado limit control of pollution to those conditions which affect public health. Control over certain mine wastes is exercised by the Colorado Fish and Game Commission. The Governor of Colorado has appointed a committee to develop recommended State water pollution control legislation. A law patterned after water pollution control legislation endorsed by the Council of State Governments would provide the desirable features required for a comprehensive water pollution control program in Colorado.

Water pollution control legislation in Nebraska is particularly weak inasmuch as it contains only indirect references to stream pollution control as a part of the duties of the State Department of Health. The only official action against willful polluters in Nebraska must be brought by the attorney of the county in which the pollution occurs. There is division of responsibility between the State Fish and Game Commission and the State Department of Health. An effective water pollution control law in Nebraska would advance a comprehensive pollution abatement program. Legislation along lines endorsed by the Council of State Governments would provide the statutory needs.

A cooperative investigation conducted by the States of Colorado, Nebraska, and Kansas, and the Public Health Service in 1949 revealed the condition of streams in the Kansas Basin. Following this investigation, the Kansas State Board of Health held hearings, then advised polluters as to necessary control measures and established a time schedule for improvements. Twenty municipalities have begun active planning for compliance with the Kansas Basin comprehensive stream pollution control program, eight have awarded contracts and now have plants under construction, four have voted bonds, and three have completed construction since 1950. Improvements and replacements of obsolete plants have also taken place in Colorado, Kansas, and Nebraska since the 1949 investigation.

The 1949 report included an evaluation of effects of stream regulation incurred by the development of reservoirs and diversions in the Kansas River system and recommended minimum flows for stream sanitation at strategic locations in the Basin. The operation plan developed for Harlan County Reservoir provides in the Republican River below the dam dilution water consistent with primary treatment of sewage.

Table 10 indicates the adequacy of municipal and industrial waste treatment facilities with respect to capacity and operation.

Table 10. Kansas River Basin - Adequacy of existing treatment facilities - Municipal and industrial

Existing treatment facilities	Number	Adequacy with relation to: Capacity Satisfactory	Capacity Unsatisfactory	Operation Satisfactory	Operation Unsatisfactory
Municipal*	120**	88	32	87	33
Industrial***	9	5	4	5	4

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

**Does not include one municipality using an obsolete septic tank installation and one municipality now completing house connections to recently constructed sewers and treatment facilities.

***Industries having separate outlets discharging wastes directly to watercourse.

POLLUTION PREVENTION MEASURES NEEDED

Present water uses and increased or additional uses possible with improved water quality, together with the protection of water rights and property values, largely determine pollution prevention measures needed. The objective of water pollution control programs is to preserve or reclaim waters to best serve these interests. Treatment requirements, like other aspects of water resources development, are generally influenced by economic considerations. In addition, the intangible aspects of moral obligation, aesthetic value, and existence of nuisance conditions exert a powerful and positive influence on the justification of waste treatment facilities. Water quality objectives have been fairly well developed for such uses as domestic and industrial water supplies, recreation, bathing, and for supporting fish life. Objectives are less well defined for other uses.

Among the most important objectives of water pollution control programs is the protection of water quality in streams used as sources of public water supply. The quality of raw water is an important factor in the design of water treatment facilities and in their subsequent operation and maintenance. The safety factor which can be incorporated in the best water treatment facility is inversely proportional to the specific concentrations of bacteria and toxic elements in the water to be used as a supply; therefore, public health and water works officials generally measure water quality in terms of its bacteriological, physical, and chemical characteristics. While definite standards of raw water quality have not been adopted, the Manual of Recommended Water Sanitation Practice, Public Health Service Bulletin No. 296, 1946, recommends the following practices: Underground waters not subject to any possible contamination and meeting in all respects the requirements of Public Health Service Drinking Water Standards as shown by satisfactory, regular, and frequent sanitary inspections and laboratory tests require no treatment. Underground or surface waters which are subject to low degree of contamination not averaging more than 50 coliforms (M.P.N.)* per 100 ml. of sample in any month, and meeting the requirements of the Public Health Service Drinking Water Standards in all other respects, should receive a minimum of simple chlorination or its equivalent. Waters which require filtration treatment for turbidity and color removal, waters of high or variable chlorine demand, and waters polluted by sewage to such an extent as to be inadmissible in the prior groups, but containing numbers of coliform bacteria averaging not more than 5,000 coliforms (M.P.N.) per 100 ml. of sample in any one month and exceeding this number in not more than 20 percent of the samples examined in any one month, should be provided complete rapid sand filtration treatment or its equivalent, together with continuous postchlorination. Waters which meet the requirements of the previous statement with respect to limiting monthly average coliform numbers, but showing numbers of coliform exceeding 5,000 M.P.N. per 100 ml. in more than 20 percent of the samples examined during any one month and not exceeding 20,000 per 100 ml. in more than 5 percent of the samples examined during any month, should be provided auxiliary treatment in addition to filtration and postchlorination. Auxiliary treatment as used here means presedimentation or prechlorination or their equivalents either separately or combined as may be necessary. Long time storage for periods of 30 days or more represent a permanent and reliable safeguard which in many cases would provide something more than an effective substitute for one or both of the two other methods indicated. Waters which do not meet the requirements cited are considered unsuitable for use as sources of water supply unless they can be brought into conformance with requirements by means of prolonged preliminary storage or some other measure of equal permanence and reliability, as heavy prechlorination and preliminary coagulation and sedimentation.

---

*Most probable number.

In addition to the recommended bacterial requirements, waters for public supply should not contain toxic, taste producing, or otherwise harmful substances or organisms not readily and completely removed by water treatment processes cited, and should be free of excessive amounts of acid, microscopic organisms, and organic matters interfering with normal operation and efficiency of water treatment processes. Whether or not upstream domestic and industrial waste is treated often determines acceptability of a water as a source of domestic or industrial supply.

Standards adopted by the Public Health Service for drinking and culinary water supply serving common carriers and interstate commerce prescribe limiting maximum concentrations of certain chemical substances inimical to public health, including the following:

Substance	Maximum concentration in parts per million
Lead	0.10
Fluoride	1.50
Arsenic	0.05
Selenium	0.05
Hexavalent chromium	0.05
Copper	3.0

These standards have received official approval by the American Water Works Association and general acceptance by official health agencies and water works authorities. Those substances which cause taste and odor problems are also important. Minute quantities of phenolic and related compounds in water supplies cause repugnant tastes and odors. Pollution control programs are aimed at virtual elimination of these substances in water serving as sources of domestic supply.

Quality requirements for industrial water supplies vary widely, depending upon the type and nature of industry under consideration. However, of general concern are the organic and biological constituents, toxic substances, and the properties of corrosion, encrustation, and slime formation. Sewage and waste control measures materially contribute to improvement of these water characteristics.

It is generally agreed that a minimum of five parts per million of dissolved oxygen is necessary in those streams of the Kansas River Basin which afford a suitable fish habitat. Oxygen content about five parts per million will usually insure a balanced aquatic life. Because of the limited amount of dilution water available during critical periods of low flow, secondary treatment for removal of not less than 75 percent of the Biochemical Oxygen Demand is required for many sources of pollution within the Basin, particularly in those instances where the quantity of waste is large, as from principal towns or where industry is concentrated. Along the small streams a degree of removal substantially in excess of 75 percent may be required to maintain the desirable oxygen level. Consistent removal of organic material approaching 90 percent is possible with secondary treatment facilities properly designed and well operated.

Water for recreational uses such as boating, and as an adjunct to natural scenery, should be free from floating solids, sludge banks, odors and discoloration. Contamination of bathing waters by sewage, especially that of recent origin, is very objectionable. Quality objectives for the bacteriological content of bathing waters are not firm, however those recommended as tentative guides for pollution control at bathing beaches by the Engineering Section, Missouri Basin Health Council, are as follows: "For bathing or swimming waters monthly arithmetical averages 'most probable numbers' of coliform organisms should not exceed 1,000 per 100 ml. during any month of the recreational season; nor exceed this number in more than 20 percent of the samples examined during any such month; nor exceed 2,400 per 100 ml. on any day. For nonbathing or nonswimming waters monthly arithmetical average 'most probable number' of coliform organisms should not exceed 5,000 per 100 ml. in any month of the recreational season, nor should exceed this number in more than 20 percent of the samples examined during any such month."

Fecal streptococci are receiving increased attention as an index of sanitary quality of bathing water. Sanitary surveys must continue to play the major role in pollution control programs as related to bathing and recreational waters.

The protection of water rights must also be considered in determining pollution prevention measures needed. Comprehensive State water pollution control measures will not interfere with water rights under the three prevailing American legal doctrines of water law - common law, reasonable use, and prior appropriation. None of these legal systems gives a license to pollute waters. West of the 98th meridian the doctrine of appropriated water rights usually prevails, although in many areas State water laws incorporate a portion of all doctrines. Where appropriated water rights prevail, consumptive use of water is permitted but no license is thus given to return water to the stream in a defiled condition. The water laws of the States of Kansas and Nebraska contain applicable portions of these doctrines. The doctrine of appropriated water rights governs in the State of Colorado.

Waste treatment measures are usually tailored to the needs of the community following engineering evaluation of local sanitary problems and the quality of water needed at downstream points. Municipal treatment plants are usually of two general types; one removes settleable material from the water under quiescent flow conditions, the other removes additional polluting materials by biological means. Within these categories numerous combinations or adaptions thereof can be used to meet the varying conditions of waste from a community and the requirements of a receiving stream. Industrial treatment processes vary widely, often within the same general type of industry. Changes in processes, by-products recovery, salvage, improved housekeeping, and comparable practices are often very effective measures of controlling industrial pollution. Control of industrial wastes may present an entirely different problem than that incurred in municipal sewage, since the wastes may contain toxic or otherwise objectionable substances not amenable to either sedimentation or biological treatment. However, the objective of the control program remains the same: protection of the water by reduction of the objectionable substances to within tolerance levels compatible with water uses. The water pollution control program in the Kansas Basin is based on these premises.

While sewage and waste treatment processes cannot be controlled precisely, they can be regulated between rather well established limits. The effective removal of solids from domestic waste by sedimentation is termed primary treatment and is generally considered to reduce the Biochemical Oxygen Demand about 35 percent. Removal of B.O.D.* by biological methods is termed secondary treatment. An effective secondary treatment plant is generally considered capable of removing from 75 to 85 percent of the B.O.D. Greater reduction, sometimes referred to as tertiary treatment, can be obtained by repetitive passages of wastes through the treatment processes or by increasing the numbers of combinations of treatment processes.

Inorganic wastes, such as most acids, alkalies and metallic ions, must be controlled by recovery, neutralization, storage, evaporation, dilution, or other specialized processes. An excellent example of an effective method of controlling inorganic waste is the returning to appropriate underground formations, waters of high chloride content which are pumped with oil to the surface. The control of oil field brines in this manner is extensively practiced in Kansas.

The following is a generalized statement of the objectives of pollution control programs in the States of Kansas, Nebraska, and Colorado:

(1) Toxic substances including metallic ions, phenolic compounds, oils, and acids must be virtually eliminated from waste effluents.

(2) The removal of settleable and floating solids to prevent sludge banks, floating materials, and nuisance conditions should be required as a minimal acceptable treatment.

(3) The degree required beyond effective primary treatment is influenced by downstream water uses and by the amount of dilution water available during periods of low flow. Biological removal of dissolved organic materials and bacteria must be provided where necessary to: maintain dissolved oxygen at levels necessary for balanced aquatic life; maintain desirable water quality for domestic, industrial, or recreational uses; and prevent nuisances or other health hazards.

---

*Biochemical Oxygen Demand is the quantity of oxygen utilized by microorganisms under aerobic conditions while feeding on and stabilizing organic materials. The test for 5-day 20°C. B.O.D. is described in Standard Methods of Water and Sewage Analysis.

(4) Industrial wastes similar in nature to municipal wastes should be based on the same premises as recommended for municipalities. For industrial wastes not similar to municipal wastes treatment should be provided as necessary to prevent deterioration of water quality in the receiving stream.

The future water pollution control programs in the Kansas Basin should include:

(1) Enactment of comprehensive pollution control legislation in Colorado and Nebraska.

(2) Construction of plants where none now exist and the improvement of existing inadequate plants.

(3) Dissemination of information concerning the effects of pollution on public health, fishing, and other water uses.

(4) Improved operation and maintenance of existing treatment plants.

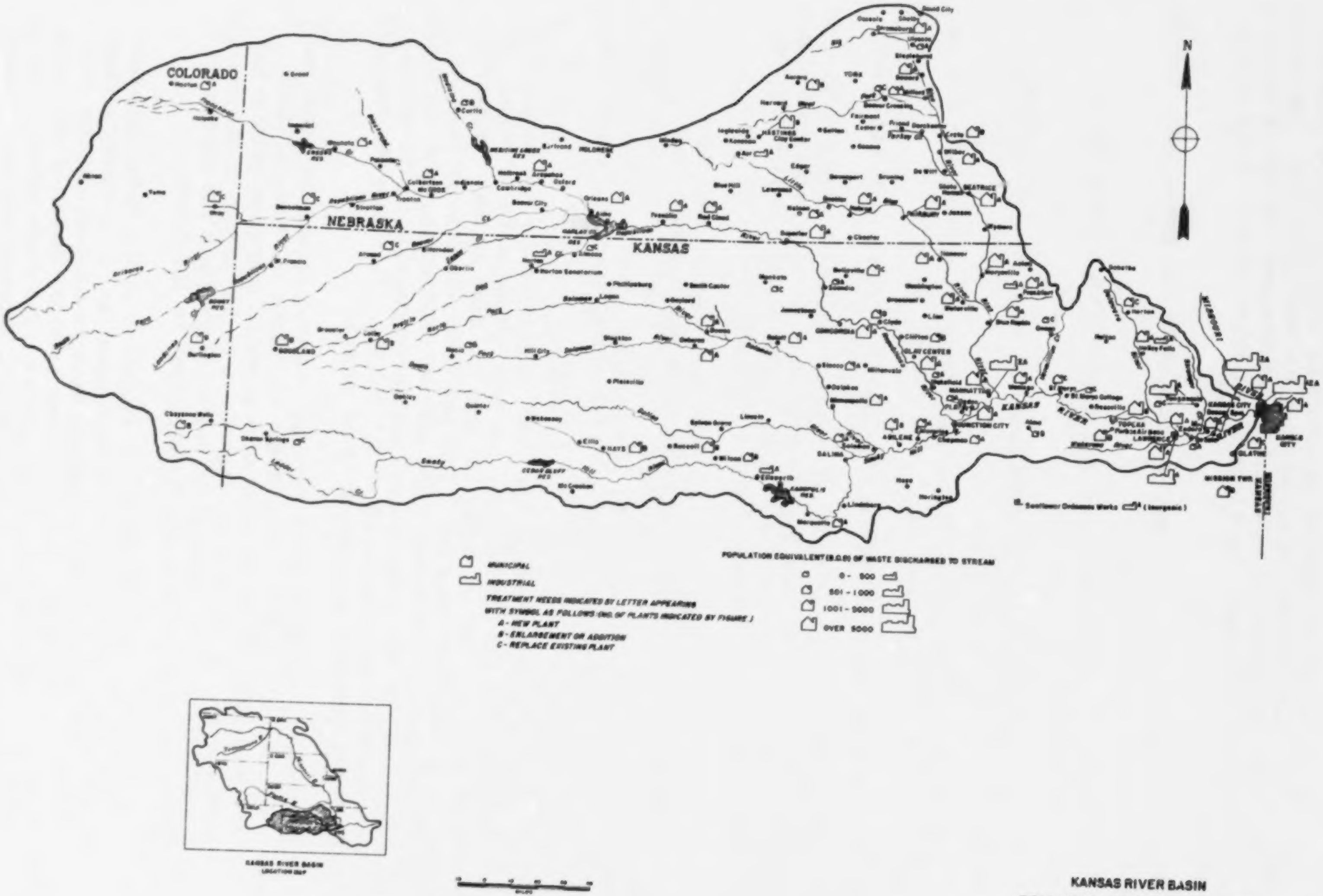
(5) Surveillance of stream conditions to supplement sewage treatment plant inspections so that the need for improved treatment can be foreseen well in advance of actual necessity, thus enabling planning and construction to be carried forward with a minimum of delay.

Municipal finance laws of Kansas have been somewhat deficient in that they do not provide for adequate operation and maintenance of sewage treatment works in certain classes of cities. Some of the difficulties experienced in Kansas would be alleviated if all cities could use revenue financing for construction, operation and maintenance of municipal sewage treatment works.

The cost of adequate sewage treatment facilities for the Kansas Basin, including operation and maintenance, has been estimated to be between $9 and $15 per year per family, depending upon the size of the community and the degree of treatment required. Cost per family is usually lower as the size of the community increases. The cost of constructing adequate treatment facilities for all known sewered wastes originating in the Kansas Basin is conservatively estimated at $18,000,000. This does not include operation, maintenance, and cost of trunk sewers.

The value of dilution water for supplementing sewage treatment has been recognized by the State Departments of Health and such dilution water has been provided below those dams where an operating program has been established. It is of great importance to the people of the Basin that a similar policy be included in operating programs for reservoirs presently under construction and those planned in the future.

Surveys of many of the sources of pollution in the Basin have been made by the State water pollution control agencies, and reports containing findings of investigations, together with recommendations for correcting or improving conditions, have been provided municipal and industrial officials and other interested parties. The State water pollution control agencies have further cooperated with representatives of numerous


COLORADO
NEBRASKA
KANSAS
MISSOURI
N
KANSAS RIVER
HASTINGS
BEATRICE
CONCORDIA
CLAY CENTER
MANHATTAN
JUNCTION CITY
ABILENE
SALINA
HAYS
TOPEKA
LAWRENCE
KANSAS CITY
OLATHE
MISSION TWP.
Sunflower Ordnance Works (Inorganic)
MUNICIPAL
INDUSTRIAL
TREATMENT NEEDS INDICATED BY LETTER APPEARING WITH SYMBOL AS FOLLOWS (NO. OF PLANTS INDICATED BY FIGURE)
A - NEW PLANT
B - ENLARGEMENT OR ADDITION
C - REPLACE EXISTING PLANT
POPULATION EQUIVALENT (B.O.D) OF WASTE DISCHARGED TO STREAM
0 - 500
501 - 1000
1001 - 5000
OVER 5000
KANSAS RIVER BASIN LOCATION MAP
MILES

KANSAS RIVER BASIN

POLLUTION ABATEMENT NEEDS

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO. 4

A

Table 6. Kansas River Basin - Basic data on sources of industrial pollution[1]

Name & Location	Type of Industry	Type of Waste Produced	Treatment or other Pollution control Measures		Populatio equivalen discharge to waterc
			Degree	Adequacy	
Kansas River					
Republican River					
Prairie Dog Creek					
Norton Ice & Meat Co. Norton, Kan.	Food products	Organic	Partial	Inadequate	10
Salt Creek					
Rendering plant, Belleville Kan.	Food products	Organic	Secondary	Adequate	
Smoky Hill River					
Solomon River					
North Fork Deer Creek					
Co-op Oil Refinery Phillipsburg, Kan.	Petroleum products	Organic & Inorganic	Partial	Adequate[2]	1,
Blue River					
Little Blue River					
Slaughterhouse, Ayr, Neb.	Food products	Organic	None	Inadequate	3
Black Vermillion River					
Soldier Creek					
Goodyear Tire Co., Topeka Kan.	Rubber products	Organic	Secondary[3]	Adequate	
DuPont, Topeka, Kan.	Chemical	Organic & Inorganic	Secondary	Adequate	10,0
Co-op Farm Chem. Assn.	Chemical	Inorganic	Partial	Inadequate	10,0
Delaware River					
Grasshopper Creek					
Rendering Plant, Horton, Kan.	Food products	Organic	Major	Adequate	--
Mitchell Sausage Factory Valley Falls, Kansas	Food products	Organic	None	Inadequate	

B

ources of industrial pollution[1]

	Type of Waste Produced	Treatment or other Pollution control Measures		Population equivalent discharged to watercourse	Pollution abatement measures needed	Project status
		Degree	Adequacy			
s	Organic	Partial	Inadequate	100	New plant or other control measures	No action
ts	Organic	Secondary	Adequate	50	Improve operation	-- -----
	Organic & Inorganic	Partial	Adequate[2]	1,500	Improve operations	
ls	Organic	None	Inadequate	350	New plant or other control measures	No action
cts	Organic	Secondary[3]	Adequate	50	None	-- ---
	Organic & Inorganic	Secondary	Adequate	10,000	None	-- ---
	Inorganic	Partial	Inadequate	10,000	Improve operation & other control measures	-- ---
ts	Organic	Major	Adequate	--	None	-- ---
ts	Organic	None	Inadequate	190	New plant or other control measures	No action

A

Table 6 (cont'd) Kansas River Basin - Basic data on sources of industrial pollution[1]

Name & Location	Type of Industry	Type of Waste Produced	Treatment or other Pollution control measures: Degree	Treatment or other Pollution control measures: Adequacy	Population Equivalent Discharged to watercourse
Delaware River					
Grasshopper Creek					
Lawrence Paper Co., Lawrence, Kan.	Paper products	Organic	None	Inadequate	15,000
Stranger Creek					
Tonganoxie Creek					
Kill Creek					
Sunflower Ordnance, Sunflower, Kan.	Chemical	Inorganic	Major	Adequate	None
Wolf Creek					
Kansas River					
Kansas City, Kan.[6]	Food, chemical, petroleum and misc. products & services	Organic & inorganic	None	Inadequate	693,000

---

1 - Includes only those industries having separate waste outlets.
2 - Improved operation of existing oil separation equipment needed.
3 - Sanitary wastes only. Industrial wastes consisting of rubber particles not treated.
6 - Includes 12 industries known to have separate outlets.

B

data on sources of industrial pollution[1]

	Type of Waste Produced	Treatment or other Pollution control measures		Population Equivalent Discharged to watercourse	Pollution abatement measures needed	Project status
		Degree	Adequacy			
ucts	Organic	None	Inadequate	15,000	Improve plant operation	-----
	Inorganic	Major	Adequate	None	Some problems due to intermittent operation	----
ical, and ucts	Organic & inorganic	None	Inadequate	693,000	New Plant	Preliminary report.

rate waste outlets.
ion equipment needed.
onsisting of rubber particles not treated.
ate outlets.

Table 8. Kansas River Basin - Progress in pollution abatement

Year		Municipal		Industrial
		Plants Completed	Design Population	Plants Completed
1946		1	2,200	0
1947		5*	8,167	0
1948		5*	2,750	0
1949		9*	27,186	0
1950		8*	30,230	0
1951		5*	7,150	0
1952		3*	1,700	0
1953)		4*	14,500	0**
1954)	Kansas Only	16*	77,460	0**
1955)		15*	62,500	0**
1956)		11*	86,670	0**
1957)		6*	15,610	0**
1958)		6*	30,000	2**

* Includes improvements to existing plants.
**Some connected to city system and treated with city wastes.

Table 9. Kansas River Basin - Summary of existing treatment

Degree of Treatment Provided	NUMBER		Population Served
	Municipalities*	Plants	
Primary	37	37	111,390
Secondary	126	126	436,950
No treatment	5	-	150,200

NOTE: Kansas data only included here.

* (See Page 30 - Kansas Report) for *.

industries and municipalities through conferences regarding specific problems of pollution, and have worked closely with the engineers employed by municipalities and industries to study pollution problems. Numerous engineering studies have been made. They generally substantiate treatment needs as indicated in this report.

Tables 11 and 12 provide a summary of the municipal and industrial wastes treatment needs together with current status of action on the part of communities or industries. Map No. 4 provides a pictorial illustration of the needs cited.

The following is a resumé of pollution control needs and associated stream conditions in the Kansas Basin:

COLORADO

Burlington

Sewage from Burlington is provided primary treatment. The effluent is used for irrigation during summer months and is discharged to Beaver Creek the rest of the year. Present facilities do not provide sufficient settling capacity. The Colorado Department of Public Health recommends that the plant be enlarged, and that chlorination be provided during the irrigation season.

Cheyenne Wells

This municipality has experienced considerable increase in population during the past 10 years and its sewers now serve approximately 1,000 people. Sewage is discharged after minor treatment into an intermittent branch tributary to the Smoky Hill River. The Department of Public Health of Colorado recommends that the present plant be replaced by secondary treatment facilities.

Wray

Sewage from about 2,100 people in Wray is given minor treatment in a septic tank before discharge into the North Fork Republican River. Local nuisance conditions develop because of inadequate treatment. The Colorado Department of Public Health recommends that the septic tank be replaced by effective primary treatment.

KANSAS

Abilene

Abilene's sewage from 5,200 people and industrial wastes with a population equivalent of 3,100 is given primary treatment. The sewage treatment plant, constructed in 1931, does not provide a degree of treatment adequate to prevent impairment of water uses in either the tributary stream which receives the sewage effluent or in the Smoky Hill River. The Kansas Board of Health recommends that the works be enlarged sufficiently to provide an adequate degree of treatment.

Table 11. Kansas River Basin - Needs for municipal and industrial waste treatment plants

	Municipal*		Industrial**
Needs	Number	Population served by facilities	Number
New plant	47	267,510	24
Enlargements or additions to existing plants	21	194,270	-
Replace existing plants	14	20,710	-
No project needed	86***	142,070	5

*Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers or other population centers.

**Industries having separate outlets discharging wastes directly to watercourse.

***Including one plant for which no population served figure is available.

Table 12. Kansas River Basin - Current status of municipal and industrial action on pollution abatement needs

Status of project	Number of municipalities*	Number of industries**
No action	53	24
Abatement ordered	-	-
Preliminary plans	11	-
Final plans approved	4	-
Bonds approved	4	-
Under construction	8	-

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

**Industries having separate outlets discharging directly to watercourse.

Almena

Approximately 450 residents of Almena are provided with treatment facilities constructed in 1922 and consisting of an Imhoff tank followed by sand filters. The effluent is discharged to Prairie Dog Creek. The plant is overloaded, obsolete, and no longer provides the treatment necessary to protect downstream water uses. The Kansas State Board of Health recommends that the plant be replaced by secondary treatment works of modern design.

Atwood

Approximately 1,600 people are served by the municipal sewer system installed in 1922. Treatment facilities which consist of an Imhoff tank and sand filters were constructed in 1927. Plant effluent is discharged into Beaver Creek, a tributary of the Republican River, in such a condition that the effluent causes local nuisance conditions in the receiving stream and impairs its downstream use. The Kansas State Board of Health recommends that the plant be replaced by a modern one incorporating secondary treatment.

Belleville

Sewage collection and treatment facilities serve approximately 2,200 residents of Belleville. The treated wastes are discharged into Salt Creek, a tributary of the Republican River. The present plant, constructed in 1918, is incapable of providing adequate treatment. Stock watering has been impaired and local nuisance conditions have occurred. The Kansas State Board of Health has recommended that present facilities be replaced with a modern unit incorporating secondary treatment. Preliminary planning of the new plant is under way.

Beloit

The municipal sewer system of Beloit serves about 3,800 residents and industry producing wastes with a population equivalent of 1,200. No treatment is provided. During periods of low flows a nuisance condition develops in the Solomon River below the outfall and fish life is jeopardized in the stream reach. The Kansas State Board of Health has recommended that a minimum of primary treatment and possibly secondary treatment be provided at Beloit. A preliminary report of sewage treatment needs has been prepared by consulting engineers for the city. Immediate construction of the proposed project is urged.

Blue Rapids

Sewage from 1,200 residents and industrial wastes equivalent to that from 900 people are discharged without treatment into the Blue River. The Kansas State Board of Health recommends that a primary treatment plant be constructed. Consulting engineers have prepared plans for the project.

Bonner Springs

Wastes from 1,850 residents of Bonner Springs are discharged untreated into the Kansas River. The Kansas State Board of Health recommends that primary treatment be provided.

The R. B. Rice Sausage Company and the Kuhn Cannery discharge large quantities of industrial wastes. These plants should provide an equivalent of primary treatment or combine their wastes with the City of Bonner Springs and treat the composite in a single treatment works.

Chapman

Chapman's sewage is discharged without treatment. The city has hired a consulting engineer and a preliminary report of the sewage treatment needs has been prepared.

Clay Center

Untreated domestic sewage and industrial wastes totaling 4,400 population equivalents are discharged into the Republican River. City authorities have begun planning for sewage treatment in compliance with the recommendation for primary treatment made by the Kansas State Board of Health. However, construction of the treatment plant has been held in abeyance pending the consummation of adequate financial arrangements.

Clifton

Sewage from Clifton is discharged into the Republican River after primary treatment is provided by a plant constructed in 1929. Wastes include the discharge from a local industry which is approximately equal in pollution capacity to the rest of the town. The State Board of Health has recommended that the capacity of the clarifier, digestor, and sludge beds be enlarged. No action has been taken by municipal officials.

Clyde

Clyde provides sewer service for approximately 930 residents. Treatment works constructed in 1916 remove settleable solids prior to discharge into the Republican River. Operational difficulties indicate that sludge digestion and sludge drying capacities should be increased, and recommendations to that effect have been made by the Kansas State Board of Health.

Colby

The municipal sewage system of Colby, serving approximately 3,500 people, provides treatment, installed in 1932, by Imhoff tank, trickling filters and secondary settling. The present population of Colby exceeds the design capacity of the plant to such an extent that the effluent is causing local nuisance conditions and curtailment of water usage in Prairie Dog Creek. The Kansas State Board of Health recommends enlargement of this plant. Preliminary planning to comply with the recommendation has been initiated.

Concordia

Untreated sewage and industrial waste equivalent to that from 10,500 people is discharged by Concordia into the Republican River. During low flow periods water quality deteriorates. The Kansas State Board of Health has recommended that primary treatment be provided. The city has voted bonds and final plans for treatment are being prepared.

Downs

The municipal sewer system serves approximately 1,200 residents; a septic tank provides a minor degree of treatment. The treated effluent is unsatisfactory and the Kansas State Board of Health recommends that the plant be replaced by a modern secondary treatment works.

Ellsworth

Ellsworth Slaughterhouse - Wastes from the livestock slaughtering house near Ellsworth having a population equivalent of 230 are discharged without treatment into Smoky Hill River. The Kansas State Board of Health has recommended that secondary treatment or comparable measures be provided.

Enterprise

No treatment is provided for the municipal wastes from approximately 700 people. The Kansas State Board of Health has recommended primary treatment for Enterprise and plans have been approved.

Eudora

Municipal wastes are discharged without treatment into the Kansas River. The sewage load originates from the 900 residents and from industry discharging wastes equivalent to an additional 540 people. Plans have been initiated by municipal officials for primary treatment.

Frankfort

Approximately 1,100 residents and industry with a population equivalent of 500 discharge wastes without treatment into the Black Vermillion River at Frankfort. The Kansas State Board of Health recommends that a secondary treatment plant be constructed to alleviate nuisance conditions in the stream and to restore stock watering uses below the town.

Glasco

Wastes from Glasco are discharged untreated into the Solomon River. The State Board of Health has recommended that a primary treatment plant be constructed.

Goodland

Partially treated sewage from Goodland is discharged into the North Fork Sappa Creek, a tributary of the Republican River. The Imhoff tank and sand filters were installed in 1921 and remodeled in 1939. At present, the system serves about 4,000 people, approximately twice the design population. Local nuisance conditions and impaired stock watering in the creek below the sewage treatment plant have led the State Board of Health of Kansas to recommend that existing facilities be enlarged sufficiently to provide a satisfactory effluent. Plans have been approved, bonds voted, and construction will begin at an early date.

Hanover

Sewage is discharged without treatment into the Little Blue River. Approximately half of the pollutional load in Hanover originates from industry. The Kansas State Board of Health recommends that primary treatment be provided.

Hays

The municipal sewer system serves approximately 6,400 residents and industry having a population equivalent of 1,400. Secondary treatment is provided and the effluent discharged to Big Creek, a tributary of the Smoky Hill River. Treatment works reconstructed in 1935 and 1945 have gradually become overloaded and an engineering study of this condition has been completed. Voters approved the bond issue in the November, 1952, election.

Horton

Sewage from approximately 2,400 residents and industrial wastes with a population equivalent of 950 people are treated in the municipal treatment facilities. As the plant is incapable of providing a satisfactory effluent, the State Board of Health has recommended that it be replaced by one of adequate design and proper location. Horton has employed consulting engineers and a preliminary report for the new project has been developed.

Hoxie

A secondary treatment plant has been provided at Hoxie. An increase in domestic sewage and industrial wastes loading necessitates addition of a final settling tank to further reduce the amount of polluting material being discharged into the South Fork Solomon River. The Kansas State Board of Health recommends that construction be carried out at an early date.

Junction City

Wastes from approximately 12,000 people are discharged without treatment into the Republican River. To protect downstream domestic and industrial water supplies, the Kansas State Board of Health recommends that a new plant providing primary treatment be constructed at Junction City. Plans were approved for a plant but the rapidly increasing population made larger facilities necessary. A bond issue was approved in November 1952.

Kansas Citys

Studies have indicated that the waste load of the two Kansas Citys discharging to the Kansas Basin is equivalent to that from a population of approximately 990,000, of which about 137,000 originate with the residents of the cities and the remainder is produced by packing houses, soap manufacturing plants, railroad yards, oil and fuel distribution plants, and various manufacturing establishments. Undesirable conditions exist in the lower three miles of the Kansas River which are very heavily polluted with organic materials. The Turkey Creek sewer which serves part of Kansas City, Missouri, the West Bottoms industrial area, and portions of Kansas City, Kansas, lying south of the Kansas River, constributes a very considerable quantity of sewage and organic material. One of the largest contributors is the Kansas City, Missouri, garbage disposal installation operated by Bennett Construction Company. Primary treatment or its equivalent is needed, and development of an over-all plan to control sewage and industrial wastes from the Kansas Citys metropolitan area is highly desirable.

At the recommendation of the Kansas State Board of Health, the City of Kansas City, Kansas, is preparing plans to treat the industrial and domestic wastes originating within its incorporated limits.

Lawrence

Municipal wastes including domestic sewage from 23,000 people and 8,000 population equivalents from industry are discharged into the Kansas River without treatment. The Kansas State Board of Health has recommended that Lawrence provide primary treatment to prevent nuisance conditions. Municipal authorities have employed consulting engineers to prepare a preliminary report on the sanitary situation.

It is recommended that industries in the Lawrence area not presently connected with the municipal sewer system be so connected when a sewage treatment works is constructed. The Lawrence Paper Mill is the principal industry not now connected to the municipal system.

Certain units of the secondary sewage treatment plant receiving the wastes from the Haskell Indian Institute, located in the southeastern section of Lawrence, need enlargement. The treated waste is discharged to the Wakarusa River.

Manhattan

The sewage collection system serves approximately 20,000 people in the Manhattan area, including Kansas State College, and industrial wastes with a population equivalent of about 6,200. Wastes are discharged without treatment into the Kansas River. There is urgent need for treatment at Manhattan to protect downstream domestic and industrial water supplies from contamination. Primary treatment has been recommended by the Kansas State Board of Health, who has given Manhattan an additional year to study the sewage treatment problem because of the work load imposed upon the city administration by the 1951 floods. The Kansas State Board of Health also recommends that industries, including the Patterson-Harwood

Laboratories and the Dearborn Packing Plant, which now discharge wastes directly to the Kansas River, be incorporated in the municipal system and their wastes provided treatment in the municipal plant. The problem of pollution at Manhattan is considered serious and action is urgently needed.

Mankato

Approximately 1,150 people of Mankato are served by the municipal sewers and treatment works. Treatment facilities, installed in 1926, consisting of an Imhoff tank and trickling filters, discharge into Buffalo Creek. Present facilities are badly overloaded and have deteriorated to such an extent that the Kansas State Board of Health recommends that they be replaced by a modern secondary treatment plant. An engineering report has been prepared in compliance with this recommendation.

Marquette

Wastes from about 550 residents and a small local industry with a population equivalent of 180 are discharged without treatment into the Smoky Hill River. The Kansas State Board of Health recommends that primary treatment be provided.

Marysville

Sewage from approximately 3,800 residents, and industrial wastes estimated at 3,000 population equivalents are discharged without treatment into the Big Blue River. The Kansas State Board of Health has urged that primary treatment be provided at Marysville to protect the waters below the city for recreational purposes, and to control nuisances. City officials have engaged engineers to prepare a preliminary report of the treatment requirements.

Minneapolis

Domestic sewage from 1,650 residents and industrial wastes with a population equivalent of 650 are discharged without treatment into the Solomon River. Pollution has curtailed use of the river for stock watering and impaired fishing value of the stream. During times of critical low flows, unsightly and odorous conditions exist. The Kansas State Board of Health has recommended that a primary sewage treatment plant be constructed.

Ogden

Municipal wastes are discharged into the Kansas River without treatment. The Kansas State Board of Health recommends that the city provide primary treatment to assist in the protection of downstream water uses.

Olathe

The Olathe sewage collection system serves 5,500 people. The present plant is unsatisfactory and the effluent causes nuisance conditions in Mill Creek. The City of Olathe has let contracts on part of the required improvements to replace the present sewage treatment works built in 1930. The modern plant will incorporate secondary treatment.

Onaga

Treated wastes from a population of 775 are discharged into the Vermillion River. The plant, built in 1926, has become obsolete in recent years and the effluent is such that stream use for livestock watering has been curtailed and fishing has been impaired. During periods of low flow, nuisance conditions develop. The Kansas State Board of Health recommends that the entire plant be replaced by one providing effective secondary treatment.

Osborne

About 1,800 people are served by Osborne's municipal sewerage system; a very minor degree of treatment is provided in a septic tank. As the treatment is insufficient to prevent deterioration of water quality in the South Fork Solomon River, the Kansas State Board of Health has recommended that the present works be replaced by a secondary treatment plant. The city has hired an engineer and preliminary planning of the project has been completed.

Phillipsburg

Co-Op Oil Refinery - The oil refinery near Phillipsburg discharges wastes and sanitary sewage through a separate sewer into a small watercourse. Oil separation equipment is provided, but miscellaneous and inadvertent spills have caused oil to be reported in excessive quantities in the receiving waterway and possibly upon the Solomon River below the junction of the creek. Ground water in the vicinity has been polluted by these wastes. The Kansas State Board of Health recommends that appropriate action be taken by the industry to abate pollution emanating from the refinery.

Russell

Secondary treatment of sewage is provided for about 5,000 residents of Russell. The plant, rebuilt in 1939, has become grossly overloaded in recent years and has resulted in a deterioration of water quality in Fossil Creek. The Kansas State Board of Health has recommended that the present facilities be sufficiently enlarged to produce a high quality effluent. City officials have engaged a consulting engineer to prepare a preliminary report. The bond issue was approved by the electorate in November 1952.

Saint Marys

Sewage and industrial wastes are given minor treatment and discharged into the Kansas River. Prior to treatment the wastes have a population equivalent of about 1,200 people. Proximity to the Topeka water works intake makes it desirable that efficient primary treatment be provided. The Kansas State Board of Health urges replacement of the plant. City officials have initiated preliminary planning. Sewage from Saint Marys College is given a minor degree of treatment in septic tanks and then discharged into the Kansas River. Existing treatment is unsatisfactory and it is recommended that the septic tanks either be replaced by a modern plant or that the college be connected to municipal sewers.

Salina

Salina recently completed construction of a new secondary plant to treat wastes from approximately 22,000 residents of the city and industry having a population equivalent of about 9,500. If sewage from the entire city is to be treated, additional pumping capacity must be installed to pump the wastes to the plant. The Kansas State Board of Health recommends that the additional pumping capacity at the lift station be provided at the earliest possible time to stop the bypassing of untreated wastes into the Smoky Hill River and that sewage and storm water sewers be separated in the commercial district of the city.

Scandia

Sewage from Scandia, estimated at 500 population equivalents, is discharged untreated into the Republican River. The Kansas State Board of Health has recommended that a primary sewage treatment plant be constructed.

Sharon Springs

Secondary treatment is provided by Sharon Springs. The plant, built in 1922 and now greatly overloaded, is no longer capable of providing the degree of treatment necessary to protect water uses and nuisances occur in Eagle Tail Creek during times of low flow. The Kansas State Board of Health recommends that the present plant be replaced by a modern secondary treatment works. The city has effected preliminary planning toward the accomplishment of the proposed project.

Solomon

Sewage from about 750 people is discharged without treatment into the Smoky Hill River. The Kansas State Board of Health has recommended that a primary treatment plant be constructed.

Tonganoxie

Franklin Ice Cream Company - The Franklin Ice Cream Company discharges dairy wastes into Tonganoxie Creek. Waste is estimated to have a population equivalent of 4,000. The company constructed an experimental treatment plant which has proved unsatisfactory. The Kansas State Board of Health recommends that adequate treatment be provided in a conventional type plant in order to prevent nuisance conditions and impairment of stock watering and fishing in Tonganoxie Creek.

Topeka

The present sewage collection and treatment works of Topeka serve 97,000 residents. Approximately 78,000 people and industrial wastes equivalent to an additional population of 40,000 are served in Plant No. 1 which provides secondary treatment. Plant No. 2 has primary facilities and treats wastes from 5,800 people. Sewage from 13,200 residents is discharged without treatment.

In 1952 contracts were let for the construction of additional treatment units at Plant No. 1. The Kansas State Board of Health has recommended that all wastes be discharged to Treatment Plant No. 1.

Forbes Air Base - The recent expansion of the air base near Topeka has so overloaded existing treatment works that it is no longer capable of providing a satisfactory effluent. The partially treated sewage causes nuisances in Shunganunga Creek. The Kansas State Board of Health has recommended rebuilding of the plant to provide conventional secondary treatment. Construction of secondary treatment improvements has begun; these facilities do not meet the minimum requirements set forth by the Kansas State Board of Health.

Turner

Untreated sewage from 1,100 pupils of the elementary and high schools is discharged to the Kansas River. The Kansas State Board of Health has recommended that a primary treatment plant be provided to remove floating solids and prevent nuisance conditions.

Valley Falls

Sewage from approximately 1,000 residents and industrial wastes with a population equivalent of 1,000 are discharged into the Delaware River at Valley Falls. Nuisance conditions have resulted in the receiving stream. The State Board of Health has recommended that a secondary treatment plant be provided. Industrial wastes from the milk processing plant and sausage factory should be properly treated or connected to the municipal system.

Wakefield

Sewage from about 500 residents of Wakefield is discharged to the Republican River. The Kansas State Board of Health has recommended that a new plant incorporating primary treatment be constructed.

Wamego

About 1,500 residents are served by the municipal sewer system which discharges sewage without treatment into the Kansas River. The discharge of untreated sewage above the water supply at Topeka is considered hazardous and the Kansas State Board of Health recommends that a minimum of primary treatment be provided.

Waterville

The municipal sewer system discharges wastes equivalent to that from a population of about 1,000, of which 400 population equivalents originate in industry. A minimum of primary treatment has been recommended by the Kansas State Board of Health.

Wilson

Secondary treatment facilities at Wilson serve approximately 700 residents and the small local industry. The plant, constructed in 1939, is no longer capable of producing the necessary degree of treatment, and the State Board of Health has recommended that the existing works be enlarged.

NEBRASKA

Arapahoe

The 1,200 residents of Arapahoe discharge untreated sewage into a small tributary of the Republican River. The State Department of Health recommends that a primary treatment plant be constructed.

Aurora

Sewage and industrial wastes equivalent to that from 5,400 people are provided secondary treatment, then discharged into Lincoln Creek. The design of the plant indicates that it was intended to serve approximately 2,700 people. The Nebraska Department of Health recommends enlargement of the plant.

Ayr

Slaughterhouse - The small slaughterhouse located about one mile from Ayr, Nebraska, discharges wastes with a population equivalent of 350 into the Little Blue River. Primary treatment facilities or other appropriate control measures are recommended.

Beatrice

Sewage and industrial wastes totaling a population equivalent of 16,000 are connected to municipal sewers. This discharge of organic material into the Blue River during periods of low flow causes localized nuisance conditions and impairs the stream for stock watering, fishing, and recreational purposes. Pollution extends into the State of Kansas and tends to maintain relatively high bacterial concentrations in river water used as the source of Marysville, Kansas, public water supply. The Nebraska Department of Health recommends that secondary treatment facilities be constructed.

Beaver City

Primary facilities consisting of an Imhoff tank treat sewage from approximately 900 people at Beaver City prior to discharge to Beaver Creek. Local nuisance conditions indicate the necessity for better treatment. The Nebraska Department of Health recommends that the present plant be enlarged.

Benkelman

Sewage from this municipality of about 1,500 people is discharged into the Republican River. Treatment was formerly provided in a septic tank which has been by-passed. Adequate treatment should be provided to alleviate local nuisances and obviate the public health hazards which develop from the use of contaminated waters for irrigation purposes. The Nebraska Department of Health recommends that existing facilities be replaced by a primary treatment plant plus chlorination.

Crete

The present sewer system and treatment facilities of Crete provide service for about 3,500 people and for industry with a 5,000 population equivalent. Treatment works, constructed in 1933, consist of primary sedimentation, trickling filters, secondary sedimentation and chlorination. The plant, originally designed to treat wastes from an equivalent population of 3,000 people, has become grossly overloaded and conditions in the Big Blue River have deteriorated badly. Stream uses affected include stock watering, fishing, and recreation. The Nebraska Department of Health recommends that the present plant be enlarged sufficiently to provide effective treatment.

Culbertson

The sewage from about 600 residents of Culbertson is discharged untreated into Republican River. It is necessary to alleviate nuisance conditions and to protect irrigation water uses below Culbertson. The Nebraska Department of Health recommends that a primary treatment works and chlorination be provided.

Curtis

Wastes from 900 residents are treated in a treatment plant constructed in 1920 which consists of an Imhoff tank and trickling filters. The effluent is discharged into Medicine Creek above Medicine Creek Reservoir. With increased recreational use of the waters below Curtis, especially in Medicine Creek Reservoir, a higher degree of treatment becomes necessary. The Nebraska Department of Health recommends that the installation be enlarged to provide adequate treatment.

Fairbury

Untreated wastes from 6,300 people and industrial wastes with a population equivalent of 8,500 cause nuisance conditions and seriously impair the Little Blue River for livestock watering, fishing, and recreation. Pollution extends into the State of Kansas. The Nebraska Department of Health recommends that secondary treatment facilities be provided.

Franklin

The sewage from the 1,600 residents of Franklin is discharged untreated into Republican River about 10 miles below Harlan County Dam. Development of irrigation increases the need for sewage treatment to control local nuisance conditions and to prevent excessive numbers of sewage organisms in the water diverted below Franklin for irrigating crops. The Nebraska Department of Health recommends that Franklin provide a primary treatment plant and chlorination.

Hastings

The sewage collection and treatment works of Hastings serve about 20,000 people and industries having a population equivalent of about 5,700. Present treatment works, constructed in 1926, consist of primary sedimentation, trickling filters, and chlorination. The plant, originally designed to treat the wastes from approximately 14,000 people, has become grossly overloaded in recent years and a program of improvements and enlargements has been inaugurated by the city. The plant effluent is discharged into a small stream incapable of assimilating large quantities of sewage, and a high degree of treatment must be provided.

Hebron

No treatment is provided sewage from the municipal system of Hebron. Wastes from a domestic population of about 2,000 and industry with a population equivalent of 800 are discharged into Little Blue River. Livestock watering and local recreation are seriously impaired by pollution contributed from Hebron. The Nebraska Department of Health recommends that secondary treatment facilities be provided.

Indianola

Approximately 700 residents of Indianola discharge their sewage through a primary treatment plant into Republican River. Present treatment works, constructed in 1938, consist of primary clarification and chlorination. It is necessary, however, to expand the plant in order to give protection to downstream water uses. Indianola is now reconstructing its treatment facilities.

Milford

Approximately 900 residents of Milford are served by municipal sewers which discharge untreated wastes into the Big Blue River. Local nuisance conditions together with impaired water uses indicate the necessity for treatment. The Nebraska Department of Health recommends that primary treatment facilities be constructed.

Nelson

Approximately 750 people residing in Nelson discharge sewage without treatment to Elk Creek, a tributary of the Little Blue River. During periods of low flow the wastes from Nelson impair the streams for stock watering or recreational uses and result in nuisance conditions. The Nebraska Department of Health recommends that secondary treatment be provided.

Orleans

This municipality is located on the upper reaches of the Harlan County Reservoir. Sewage from the 900 residents and industrial wastes from a creamery are discharged untreated into the Republican River. To protect recreational use of the Harlan County Reservoir, the Nebraska Department of Health recommends that a primary treatment plant and chlorination be provided at Orleans. Adequate pretreatment of creamery wastes should be instituted prior to disposal into municipal sewers in order to enable the municipal treatment plant to maintain adequate treatment efficiencies.

Red Cloud

Red Cloud, located about 30 miles below Franklin, discharges untreated sewage into the Republican River. Development of irrigation affects Red Cloud much the same way as it does the other cities and towns below Harlan County Reservoir, and thereby increases the need for sewage treatment. The State Department of Health recommends that this city of 1,700 people provide primary treatment facilities and chlorination.

Seward

Sewage and industrial wastes with a population equivalent of 4,100 are discharged untreated into the Big Blue River. Approximately 3,100 people are served by sewers and the remainder of the wastes originates in local industries. Discharge of untreated sewage has produced nuisance conditions in the stream during periods of low flow, and has resulted in conditions undesirable for stock watering. Reaches of the stream used for recreation have also been impaired. The Nebraska Department of Health recommends that a primary treatment plant be constructed.

Stromsburg

Sewage from about 1,100 residents of this municipality is discharged untreated into North Branch, a tributary of the Big Blue River. The discharge of untreated sewage into the creek has caused local nuisance conditions and curtailed the use of the stream for stock watering. The Nebraska Department of Health recommends that a secondary treatment plant be constructed.

Superior

Sewage from the domestic population of Superior and an industry is discharged untreated into the Republican River just prior to the stream's entrance into the State of Kansas. Numerous diversions for irrigation below Superior make it necessary that sewage treatment be provided to protect water uses. The Nebraska Department of Health recommends that a primary treatment plant for both municipal and industrial wastes be provided. Chlorination of treatment plant effluent will be necessary with development of irrigation below Superior.

Ulysses

Approximately 300 residents of Ulysses discharge untreated sewage into the Big Blue River. The Nebraska Department of Health recommends that a primary treatment plant be provided.

Wauneta

Approximately 900 people are served by municipal sewers which discharge untreated wastes into Frenchman River. Closure of Enders Dam and flow regulation of Frenchman River increase the need for treatment to prevent deterioration of water for irrigation and livestock watering. The Nebraska Department of Health recommends that a primary treatment plant and chlorination be provided.

Wilber

The municipality of Wilber discharges untreated wastes from 1,300 people into the Big Blue River about 10 miles below Crete. Livestock watering, fishing, and local recreation are impaired because of the waste entering the stream. The Nebraska Department of Health recommends that primary treatment be provided.